TECHNOLOGY DEPT.

AMERICAN MACHINIST

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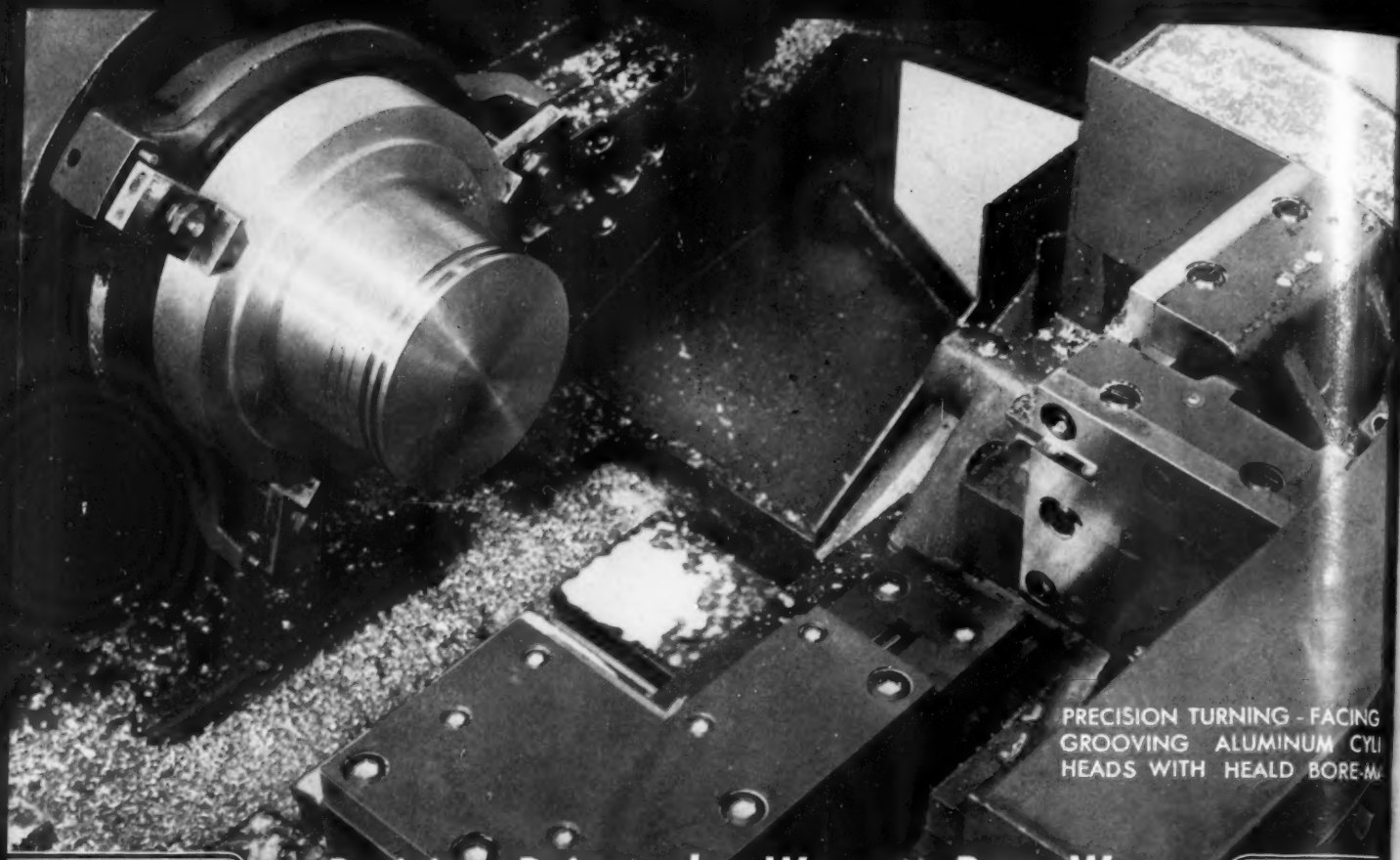
Tooling for the Constellation — Page 109



PRECISION TURNING - FACING
GROOVING ALUMINUM CYLI
HEADS WITH HEALD BORE-M

Borizing Points the Way to Post War Precision Finishing of Light Metals

BORIZED ALUMINUM AND MAGNESIUM AIRCRAFT PARTS

★

Adapter Assemblies
Bases
Bearing and Pump Casings
Bearing Housings
Bearing Supports
Boost Control Housings
Camshaft Brackets
Camshaft Housings
Caps
Carburetor Bodies
Carburetor Main Bodies
Clutch Selector Housings
Covers
Cylinders
Cylinder Heads
Cylinder Muffs
Crankcase Assemblies
Crankcase Sections
Crankcase Blower Sections
Crankcase Front Sections
Crankcase Center Sections
Crankcase Covers
Crankcase Rear Covers
Intermediate Crankcases
Intermediate Rear Crankcases
Lower Half Crankcases
Rear Crankcases
Crankcase Bearing Caps
Crankpin Oil Plugs
Crankshaft Oil Plugs
Drive Shaft Supports
Front Bearing Caps
Front Covers
Fuel Pump Bodies
Fuel Pump Drive Shafts
Gear Boxes
Gear Cases

What can be accomplished with light metals such as aluminum and magnesium, and indicative of what will be done with these alloys in post-war manufacturing, has already been shown by the aircraft industry. Approximately 40 per cent of the aircraft engine is comprised of light metals, and largely because of this it has been possible to reduce the horsepower-weight ratio to 1 lb. per horsepower.

Just as valuable as the aircraft industry's lesson to the post-war world on the use of light metals are the lessons to be learned from their methods and practices in machining aluminum and magnesium. Their methods of finishing parts made of these metals deserves particular attention. Study of their processes reveals the outstanding fact that *borizing*, or precision boring, turning facing, and grooving with cemented carbide or diamond tools, is used almost exclusively for precision finishing of aluminum and magnesium. The partial list of aircraft parts given herewith is eloquent testimony of this—all of them are made of either aluminum or magnesium and all of them are *borized*.

For More Precision, FASTER

bring your problems to

The HEALD MACHINE CO., Worcester, Mass.

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Gun Turret Saddle
Gyro Pilot Pump F
Gyro Pilot Servo B
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Propeller Shaft Be
Propeller Shaft Pi
Rear Cam Support
Rear Reduction G
Reduction Drive S
Reduction Gear C
Regulator Covers
Regulator Housing
Selsyn Motor Par
Shock Absorber F
Speed Reducer H
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Supercharger Fro
Supercharger Gea
Supercharger Rea
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American Machinist

August 19, 1943

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MAJOR ARTICLES

Rifle Drilling With Carbides.....*T. R. Skofteland* 83
Bearing Inspection Without Contact..... 86
Control Gives True Leadscrews.....*Fred Schoeffler* 90
Their Handicaps Don't Interfere.....*Leon J. Keller* 93
Processing Layouts for Metal Cleaning.....*C. W. Smith* 97
Developments in Stretch Presses.....*C. L. Fenn* 99
War Winning Suggestions..... 106

ARMAMENT SECTION

Tooling for the Constellation.....*G. A. Betts* 109

SHORT ARTICLES

Work Table Saves Clamping Time.....*Albert Kelleher* 98
Surplus Tools.....*Leo Malchin* 153

IDEAS FROM PRACTICAL MEN

Coiled Spring Works Ratchet Wrench.....*Raymond Hodge* 103
Simplifies Taper Elimination When Grinding..*Ralph Waech* 103
Reclaiming Solders When Tinning Coppers.....*A. Eyles* 104
Length and Centrality Gage for Trunnions...*Frank Hartley* 104
Two-Way Drill Jig for Right-Angle Holes.....*F. Scriber* 105

NEWS OF THE INDUSTRY

Gaging Business.... 128b
Inside Detroit 128c
Wartime Washington 128g
Spotting the Air News 128i
Names in the News.. 128k
Obituaries 128l

DEPARTMENTS

What's in This Issue... 81
Reference Book Sheet.. 125
Editorial 128a
Shop Equipment News. 129
New Materials 144
Trade Publications..... 146
New Books 150
Seen and Heard..... 151

AMERICAN MACHINIST —chips

Inventions . . . Looking through a recent copy of the Allis-Chalmers *Electrical Review*, we noted with interest one of a series of articles by Miles Henninger, Patent Attorney for the company, describing the 19 most famous American inventions. The first three dealt with food and clothing: Whitney's cotton gin, McCormick's harvester and Howe's sewing machine. All, by the way, in the Metal-Working family.

Asking "Are there simple, yet important, things left to invent?", the articles illustrate what must be combined with an inventive idea to make it useful to the public and a source of profit to the inventor and exploiter.

It was news to us, incidentally, to learn that the operation of the U.S. patent system has resulted in crediting Americans with 75% of all the world-famous inventions. And we'll wager the percentage will be even higher when the full stories of our war-born inventions can be told.

o

Fashion Note . . . *The girls in the office here at* American Machinist *agree that The Hydraulic Press Mfg. Co. went the corset manufacturers one better in a recent ad. Featured was "the only 'skin stretcher' with two-way stretch and all-hydraulic control."*

o

Oil Problem Solved . . . George Dixon, whose newspaper column on the Washington scene has given us many a chuckle, caused a real old-fashioned belly laugh with the following:

"In the town of Midland, Tex., dwells one of the world's great economists, unknown and unsung.

"It appears that the oil industry has been imploring the Office of Price Administration to raise the ceiling on the price per barrel of crude oil. Unless the price goes up, the industry wails, it will soon be more concerned with breadlines than pipelines. But all it gets from OPA is involved and verbose refusals, the gist of which is, 'Nuts to you, oil industry!'

"Crude oil is sold by the barrel and the standard-sized barrel in America is 42 gallons. In this simple fact, the giant of economics has found the solution.

"He outlined it in a letter to Russell Brown, general counsel of the Independent Petroleum Association of America.

" 'I have the solution for the whole problem,' he wrote Brown. 'The OPA says it won't increase the price per barrel. All right, leave the price where it is—which is a national average of about $1.18 per barrel.

" 'But cut the size of the barrel to 30 gallons. The industry would get as much money for less oil and the OPA would be satisfied because the price per barrel would remain the same.

" 'Moreover, Ickes would be delighted, no doubt, because it would increase the oil reserves. Let me explain this point.

" 'The present oil reserve is approximately 20,000,000,000 barrels. But, if each barrel was cut to 30 gallons, the number of barrels on hand would automatically jump to 28,000,000,000 barrels. That would be 8,000,000,000 barrels more than we have now!' "

There simply *must* be an idea in there that can be applied to the Metal-Working industry! It's a swell principle.

Production Publicity . . . *We've been watching with a great deal of interest the way more and more ads in newspapers and general magazines feature kind words for the Metal-Working production man.*

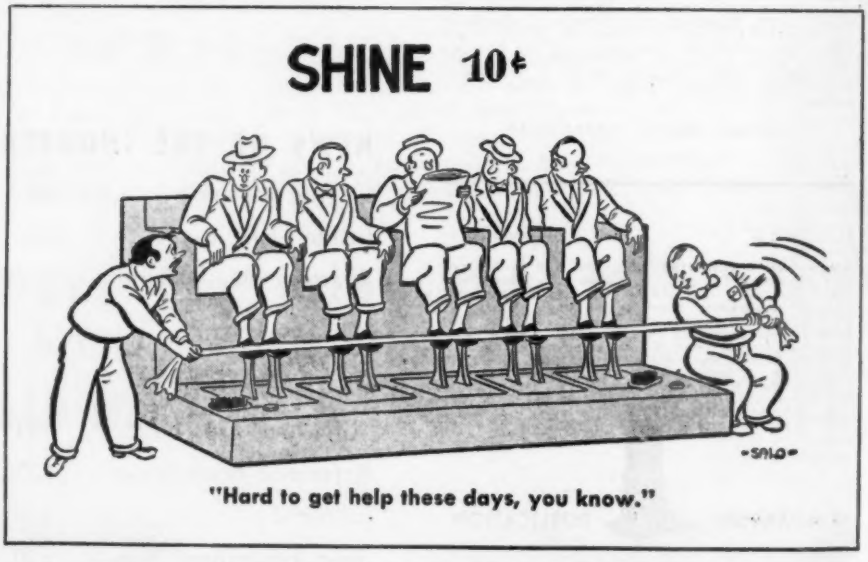
Firms who normally make automobiles, farm equipment, commercial aircraft, locomotives, household appliances and other products find that even though Uncle Sam is their only customer, they still have something to sell to John Public. It may be a message to bolster morale, or a story of participation in the war effort, or a reminder of past quality and even better products to come. Whatever the angle, chances are you'll find it based on the invaluable service rendered to America by the men who make things out of metal.

o

More Magnesium . . . The talk around Washington, we hear, is that there is really a big supply of magnesium available these days. One reason for this is undoubtedly the mammoth magnesium plant now in operation at Las Vegas, Nevada. A yarn about the $100,000,000 project was carried in the June-July issue of *Link-Belt News* . . . and included pictures and descriptions of some of the company's installations there.

This lightweight metal packs a heavy punch when used in bombs, tracer bullets, planes and other war goods. We're glad we have enough . . . and we'd like to suggest that interested parties start figuring *now* how a plentiful supply of magnesium will affect their post-war future.

HERE'S PRODUCTION FOR YOU!



"Hard to get help these days, you know."

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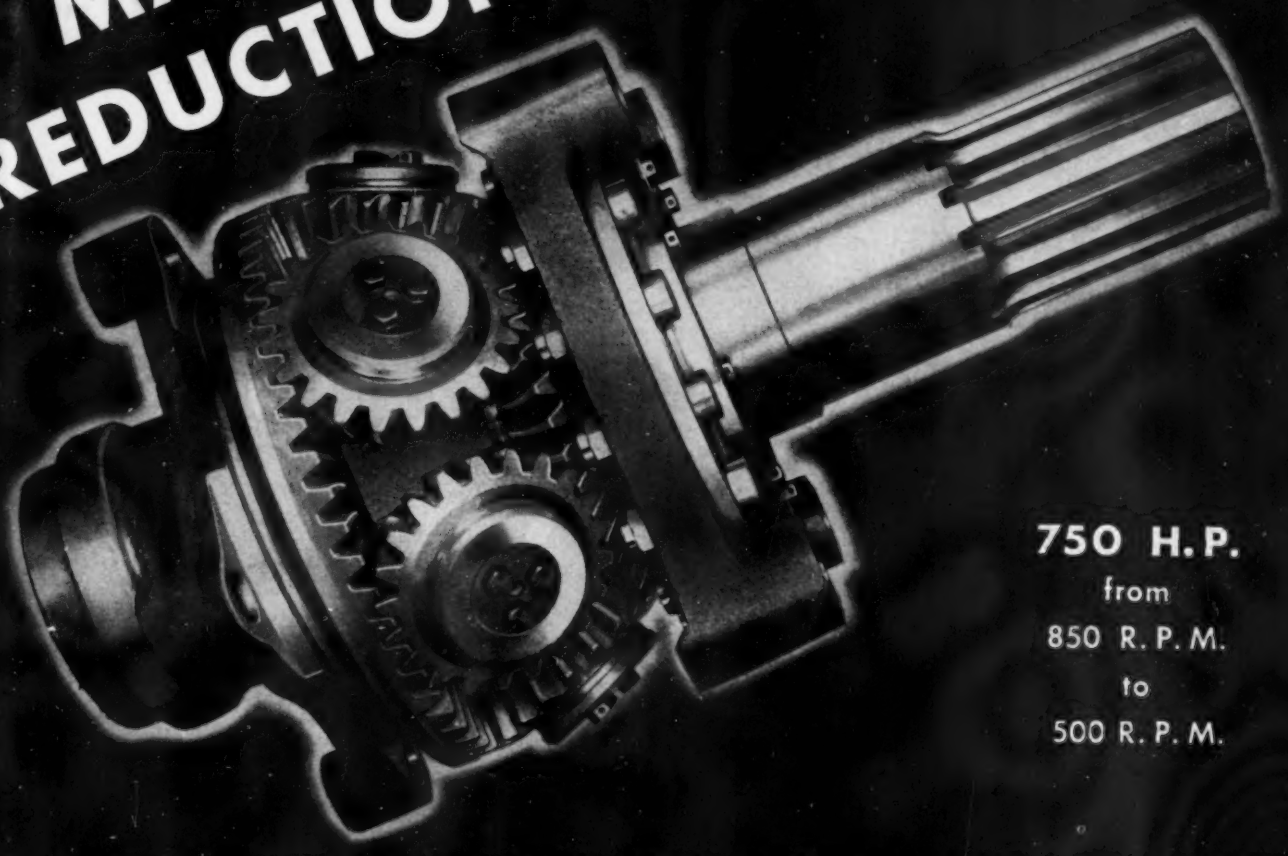
MARINE REDUCTION UNIT



750 H.P.
from
850 R.P.M.
to
500 R.P.M.

Marine drive manufacturers, faced with the problem of making better reduction units than ever before, have found that bevel gear planetary units meet and surpass their production and performance requirements.

Examine the advantages these units offer:

1. Compact, light, straight-line design
   Unit shown is only 18" diameter.
2. High load capacity
   Multiple pinions share load equally.
3. Fast, accurate manufacture
   Bevel gears cut by efficient generating method in standard Gleason machines.
4. Assembly control
   Bevel gears adjusted in assembly for control of backlash.
5. Range of Application
   Reductions from approximately 1.5/1 to 2.5/1. Similiar units also used as reverse drives.

Extend these advantages to your drive applications. The Gleason Works, with over 75 years' experience in the bevel gear industry, stands ready to help you. Our engineers will be pleased to aid in designing your planetary gears and in specifying the correct Gleason machines for their manufacture.

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

ARMY E NAVY

1 ----

2 ----

CINCINNATI

Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

THE CINCINNATI MI

MILLING MACHINE

MILLING WITH HIGH SPEED STEEL covers cutter design, speeds and feeds for milling cutters, action of cutting fluids, care of cutters, and other pertinent information.

MILLING MACHINE PRACTICE covers an analysis of milling processes, classification and use of milling cutters, a discussion of various milling machines, and other useful data.

re weapons of production

RE'S HOW TO MAKE THEM LAST LONGER!

Cutting tools are being wasted at an alarming rate. Millions of workers, with little or no previous experience, are now using metal cutting equipment. And because of their lack of knowledge in the care of the machines they are operating, this group has unintentionally created a cutting tool problem so serious it now appears the $450,000,000 output of tool steels and cutting tools will not meet the requirements of sustained production.

Fortunately it's not too late to do something about it. The situation can be remedied through education and cooperation. But it's an individual responsibility. Everyone must do his part because the need is urgent. Do your share by writing for the two books illustrated and studying the information contained therein. There's a wealth of helpful data in each one. Copies are yours for the asking. Two additional books on metal cutting are also available. They are: "Machining with Single Point Tools," and "Maximum Shell Production." If you can use these books, be sure to ask for them specifically.

AT MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

CHINE

BROACHING MACHINES • GRINDING MACHINES • LAPPING MACHINES

How inspection with Jones & Lamson Optical Comparators

READIN'

1. Electrical equipment
2. Radios
3. Slide fasteners
4. Type faces
5. Paper making machinery
6. Button dies (plastic)
7. Matches

'RITIN'

1. Hardware
2. Textile machinery
3. Hair clippers
4. Eye glasses
5. Typewriters
6. Bottle molds and closures
7. Pen points

During the past 22 years, **Jones & Lamson Optical Comparators** have been used for inspecting thousands of interesting and peculiar jobs. Readin', 'ritin', and 'rithmetic have been definitely helped, just as have the food you eat — the clothes you wear — the room you're in — the war you're fighting. Whatever product you manufacture, be it mechanical, electrical — anything — call in a Jones & Lamson inspection engineer. He may be able to show you how to inspect it more accurately, faster, at less cost, through the use of **Jones & Lamson Optical Comparators.**

FAY AUTOMATIC LATHES

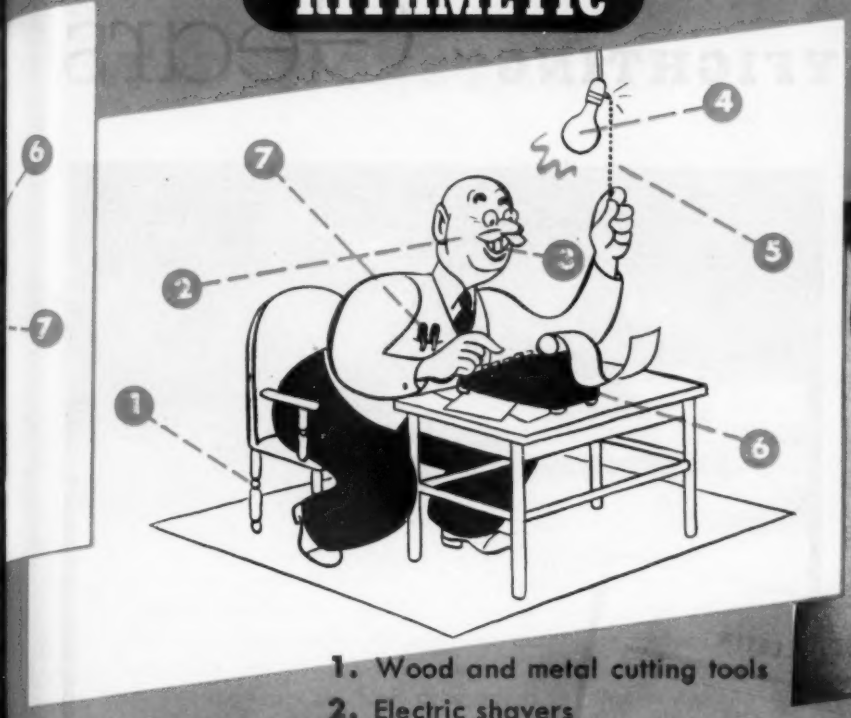
AUTOMATIC THREAD GRINDERS

OPTICAL COMPARATORS

AUTOMATIC OPENING THREADING DIES

helps your

'RITHMETIC



1. Wood and metal cutting tools
2. Electric shavers
3. Tooth brushes
4. Light bulbs
5. Light chains
6. Adding machines
7. Automatic pens and pencils

The enlarged shadow image reveals, at a glance, the exactness of all dimensions of even the most complicated tools, parts and products.

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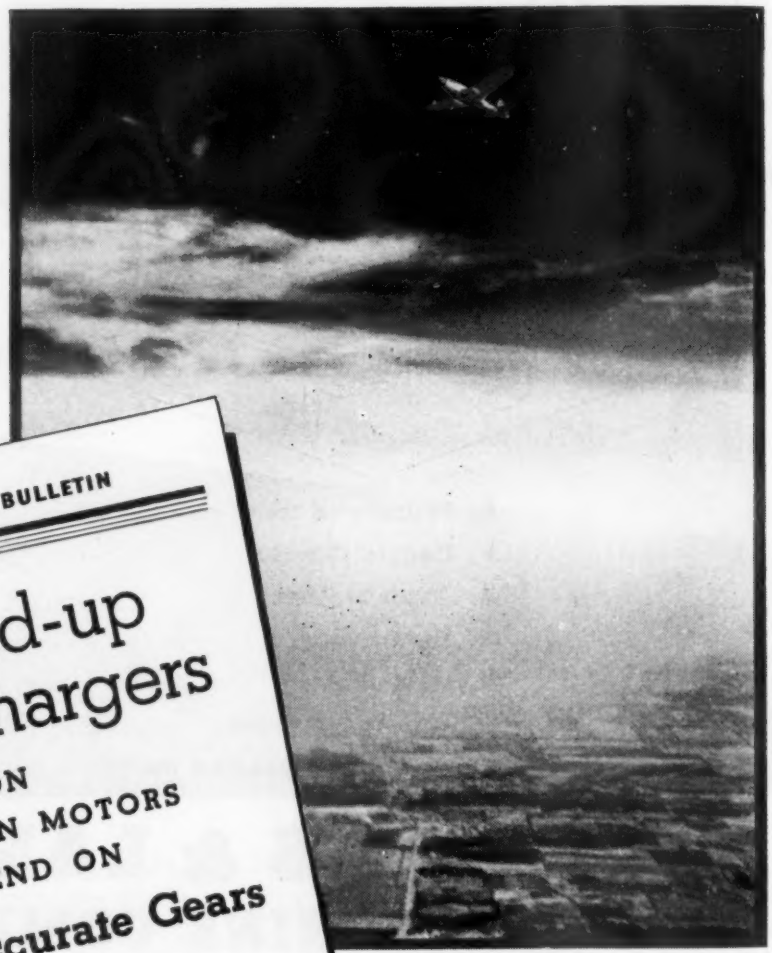
SADDLE TYPE
UNIVERSAL TURRET LATHES

PROFIT-PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHES

"SKYFIGHTING" Gears



WAR PRODUCTION BULLETIN

Geared-up Superchargers

ON
AVIATION MOTORS
DEPEND ON

Super-Accurate Gears

FOR OPERATING AT
SUPER SPEEDS

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

APTLY DEMONSTRATE

A BASIC FELLOWS PRINCIPLE

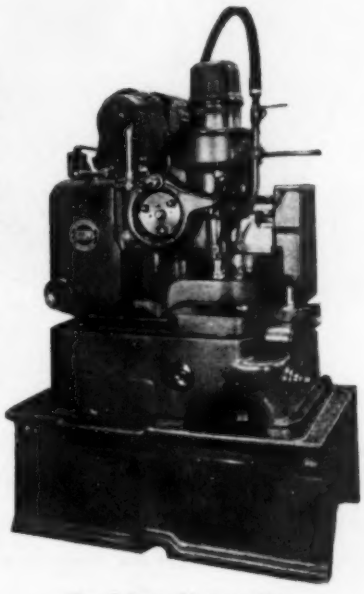
★ **High-accuracy gears cost less when the initial tooth cutting is done to Gear Shaper precision. Time, and tool wear in subsequent operations are thereby lessened.**

The aviation motor plants in this and other United Nations countries have put this practice into most complete fashion. And for a good reason. High accuracy is imperative in gears for aeroplane motors. The lives of highly-trained men depend upon it. Coupled with this necessity for high accuracy is the imperative need for unheard of speed in production to meet delivery schedules.

What Fellows Gear Shapers, and Gear Production Methods have done to meet this demand for high accuracy and low costs, especially under war time stress, should be of interest to every gear manufacturer . . . When peace time planning is again resumed.

You should become acquainted now with Fellows Gear Production equipment in preparation for future requirements. Our latest catalog, "The Fellows Method" will give you a concise review of the latest in Gear Production equipment.

For your copy, Write: The Fellows Gear Shaper Company, Springfield, Vermont, — or 616 Fisher Building, Detroit 2, or 640 West Town Office Building, Chicago 12.



The Fellows 7A-type High-Speed Gear Shaper for quantity production of internal and external spur and helical gears.

Method

. . . . FROM BLANK TO FINISHED GEAR

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CENTERLESS PRINCIPLE
With the Aid of A Wood Model
CINCINNATI GRINDERS INCORPORATED CINCINNATI, OHIO, U.S.A.

Your grinding men will be more interested in their work if they understand what's going on in the machines they operate — how the various elements function and why the machine does what it does. So many requests have come from operators and plant managers for more information on the centerless principle that the engineers here at Grinding Headquarters have written two books on the subject. One: "Explaining the Centerless Principle with the Aid of a Wood Model." This book and model are used in our own training program, and have proved unusually beneficial in helping operators understand the fundamentals of centerless grinding. Two: "Principles of Centerless Grinding" treats the subject more thoroughly, and includes examples, controls and construction details as well as production data. These two books are yours for the asking. You'll find them exceedingly helpful in training your men. Send for your copies today.

Navy E awarded March 6, 1942. Renewal star awarded August 29, 1942, along with Army-Navy E. The second star was awarded Feb. 23, 1943.

CINCINNATI

CENTER TYPE GRINDING MACHINES

C

centerless grinding

CINCINNATI

At the right is a CINCINNATI No. 2 Centerless Grinding Machine. Complete specifications on features and benefits given in Catalog G-456-1 . . . Copy sent on request.

GRINDERS INCORPORATED

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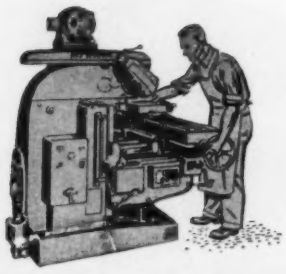
CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES



OPERATORS ALWAYS HAVE

"Control of the Situation"

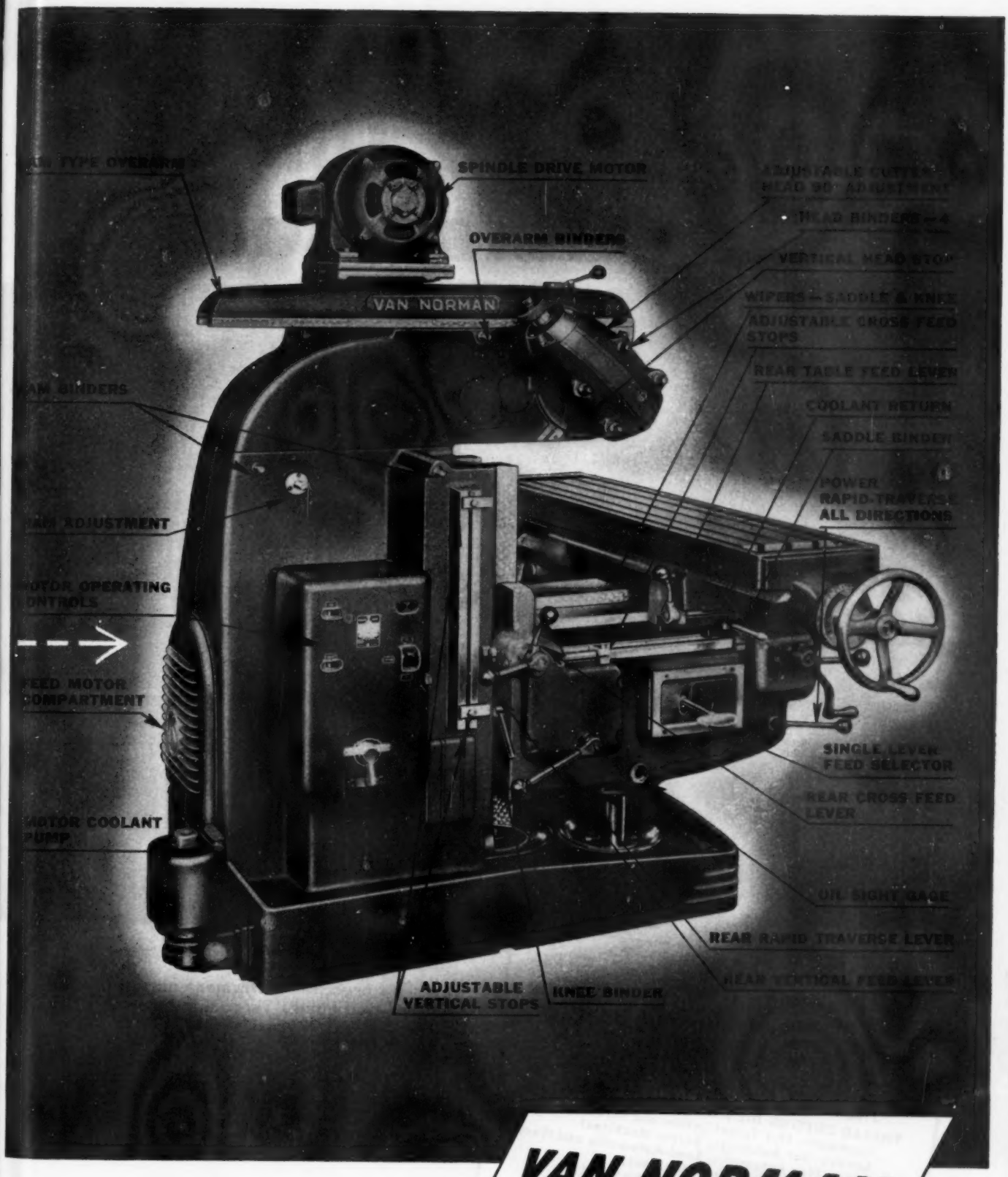
...ON VAN NORMAN RAM-TYPE MILLERS

All controls and adjustments are right at hand . . . quick and easy to use . . . on Van Norman Ram-Type Millers. So operators can turn out better work and more of it, in less time. Operators also find their work lightened and speeded up by front-and-rear controls of power feeds and 6-way rapid traverse . . . single-lever selectors of feeds and speeds . . . and large, glare-proofed dials that are easy to read.

Many jobs can be carried to completion . . . through successive vertical, angular and horizontal cuts on the same machine . . . simply by resetting the cutterhead, instead of taking the time (and the risk of errors) otherwise required to reset the work. In fact, every feature of Van Norman Ram-Type Millers is designed to combine highest accuracy with greatest ease of operation, on toolroom and production jobs.

SPECIFICATIONS:
No. 26 RAM-TYPE MILLER:
Table: 50" x 12"
Range: 28" longitudinal, 12" cross, 18" vertical
18 Speeds: 30 to 1500 rpm
18 Feeds: ⅛" to 32"

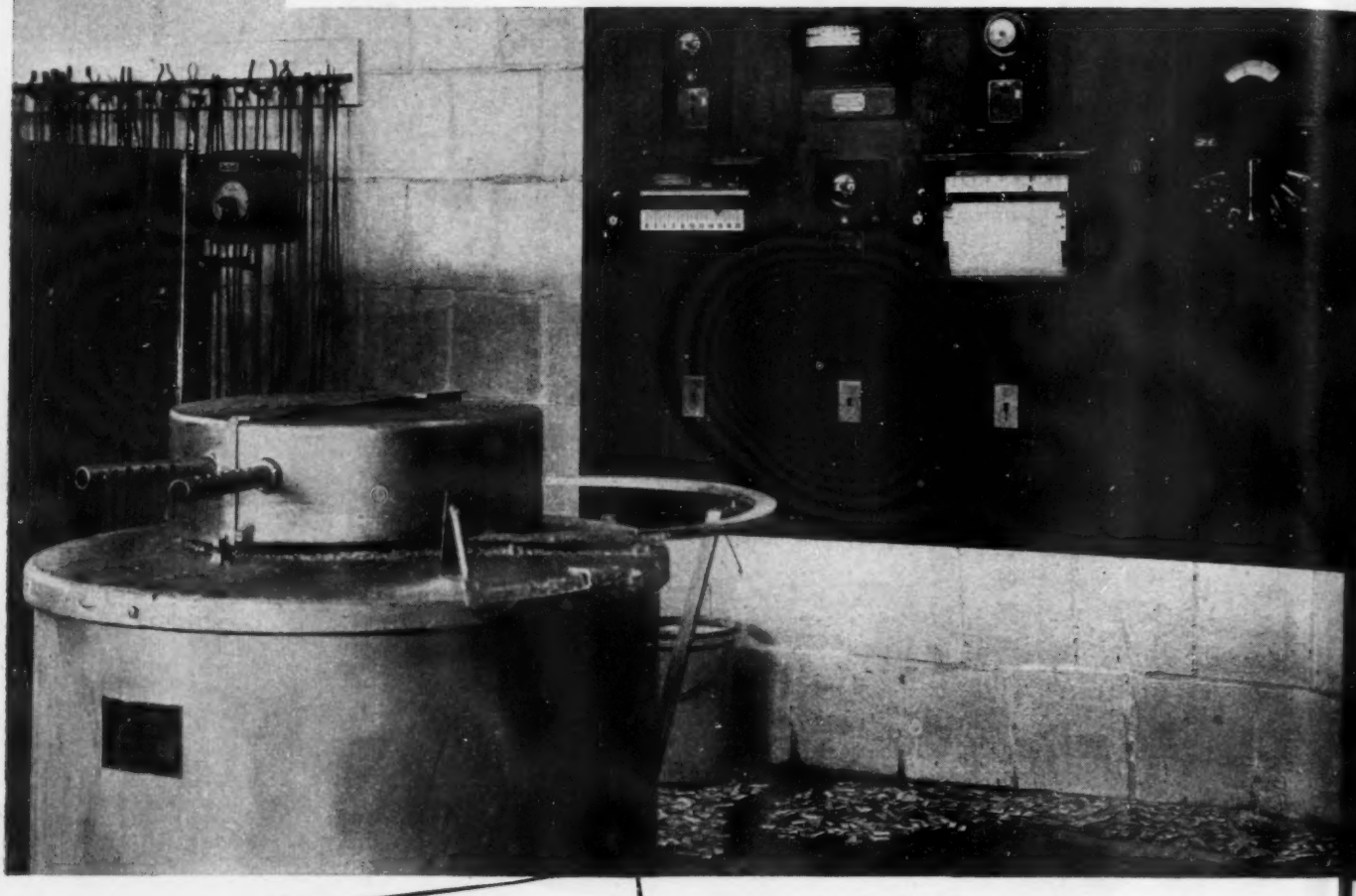
VAN NORMAN MACHINE TOOL CO., SPRINGFIELD,



MASSACHUSETTS

VAN NORMAN
Milling Machines

LANDIS Threading Precision Control



The LANDIS LINE

THREAD CUTTING MACHINES
- Landmaco Threading Machines
- Bolt Factory Threaders
- Automatic Forming and Threading Machines
- 4 Spindle Semi-Automatic Threading Machines
- Pipe and Nipple Threading Machines

THREAD CUTTING DIE HEADS
- Landmatic (for Turret Lathes and Screw Machines)
- Landex (for Automatic Screw Machines)
- Lanco (for Automatic, Semi-Automatic and Hand-Operated Threading Machines)
- Lanco Pipe and Nipple Threading Heads
- Stationary Pipe Die Heads
- Reverse Taper Die Heads
- Standard Rotary Die Heads

PRECISION THREAD GRINDERS

PIPE THREADING AND CUTTING MACHINES

ROLLER PIPE CUTTERS

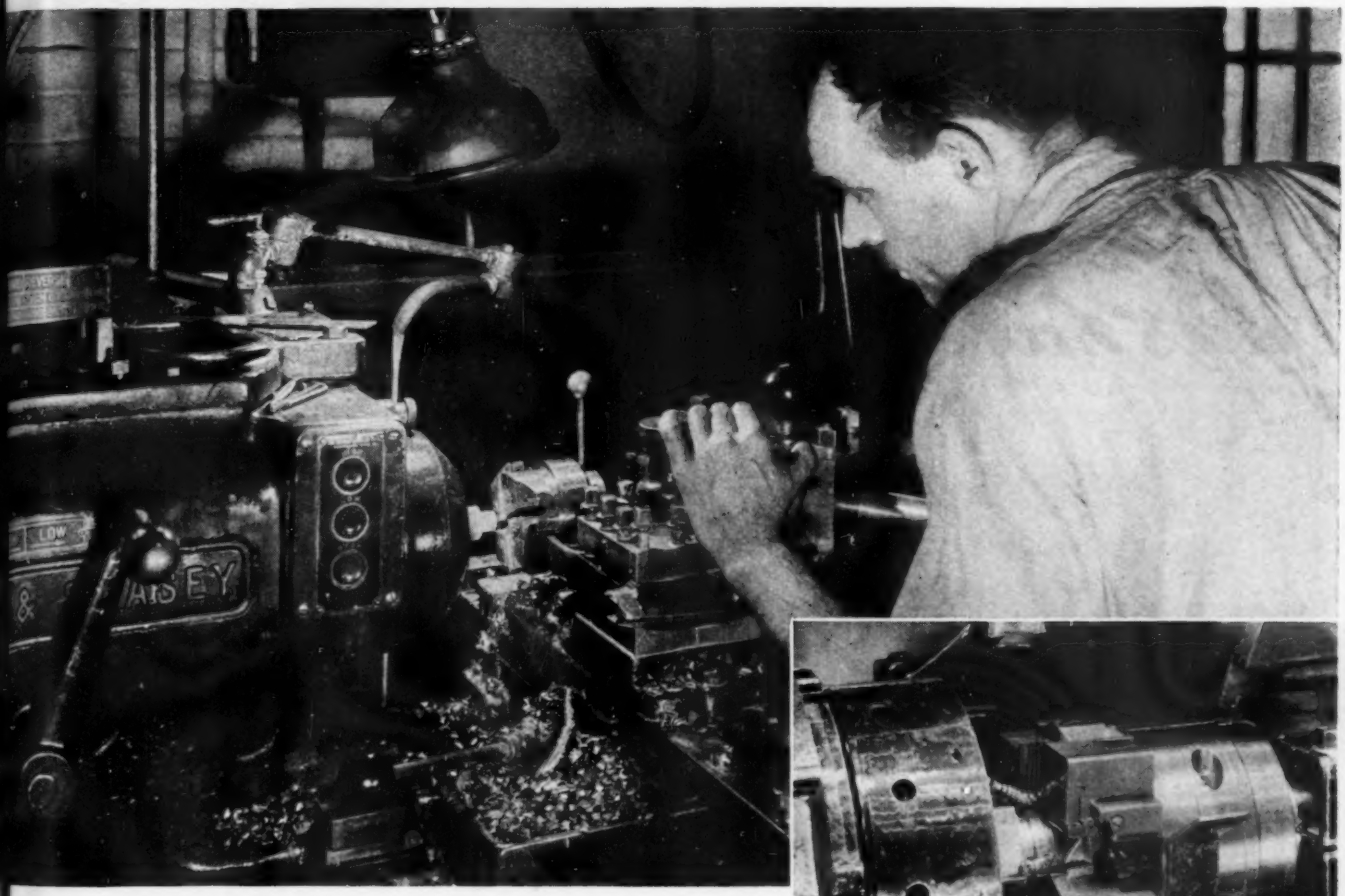
CHASER GRINDERS

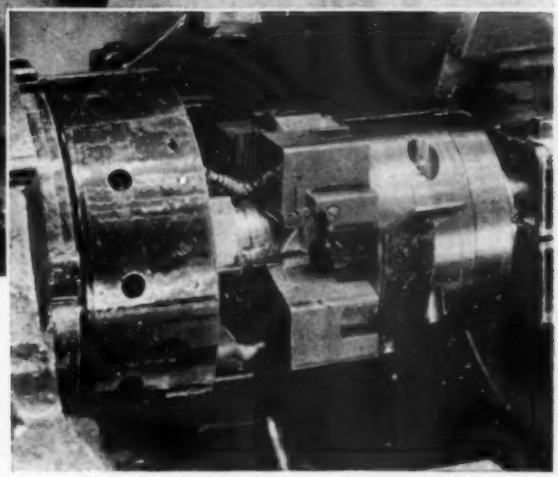
COLLAPSIBLE AND ADJUSTABLE TAPS

Large precision instrument manufacturers have used Landis Threading Equipment for many years in cutting threads for small parts of precision instruments for recording temperature and heat control in industrial plants. Landis threading accuracy on a wide variety of metals is important to the performance of these instruments.

Write for the Booklet
"BE THREADWISE"

Accuracy is Important to Instruments in War Plants





Landis Threads are not only serving in the implements of war . . . they are also playing a vital part in controlling operations of the war plants turning out war materiel. Quality of steel and other metals depends on accuracy of heat control. Temperature control instruments maintain high efficiency and the safety of workers. In dozens of ways precision instruments help keep war production at high efficiency and Landis threading accuracy helps make this possible.

LANDIS MACHINE COMPANY

WAYNESBORO · PENNA · U·S·A·

THE PAYROLL DOLLAR *buys more*

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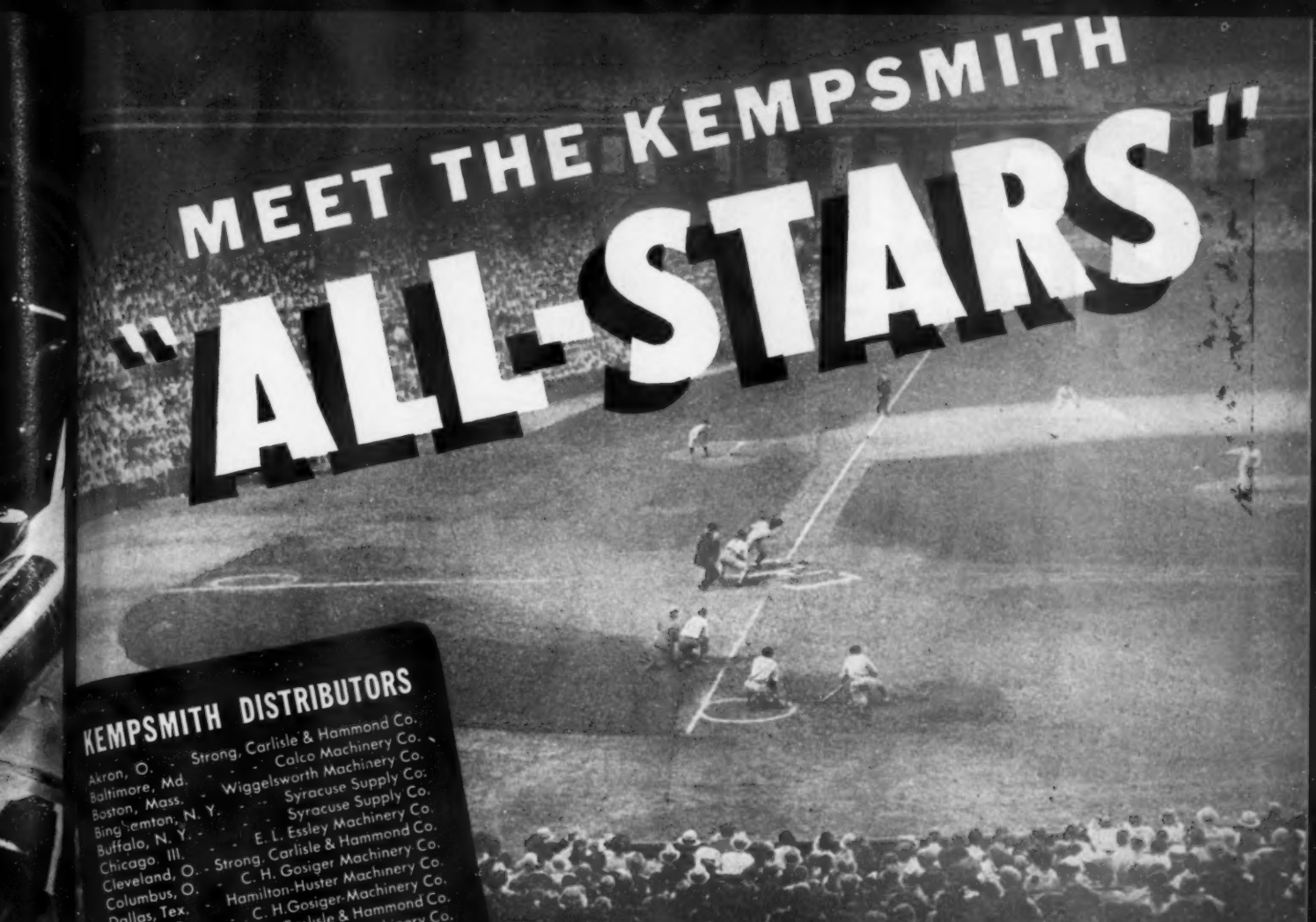
HERE, for example, is an "American" in one of our most prominent shops actually producing four (4) times more work than the fairly modern machine it replaced. In hundreds of plants "American" Multi-Production Lathes are lightening the burden of higher wages, shorter hours, increased taxes and inexperienced operators. That is why "Americans" are the choice of cost-minded production men. The many productive features responsible for such results are clearly illustrated and described by our new bulletin No. 445.

THE AMERICAN TOOL WORKS COMPANY

LATHES • RADIALS • SHAPERS

CINCINNATI, OHIO, U. S. A.

MEET THE KEMPSMITH "ALL-STARS"



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KEMPSMITH distributors are of big league calibre — the "ALL STARS" of the machine tool industry — trained and equipped to supply and service every type of tool, always dependable in the pinches. Phone your neighborhood Kempsmith distributor regarding your machining problems. He will gladly go "to bat" for you.

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Precision Built Milling Machines Since 1888

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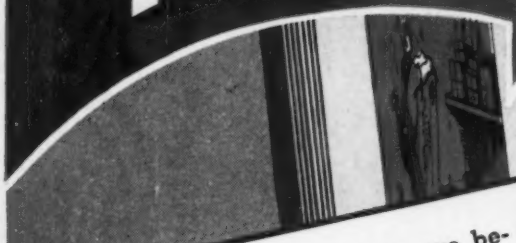


Grinding machine operators are beset by many temptations. One of these is feeding the wheel too fast. Seems like the thing to do in order to complete a job quickly. All too often both production and finish suffer in the end. The operator who wishes to familiarize himself with proper wheel feed procedure may do so by sending for the book "Better Grinding." Just mail the coupon at the bottom of the opposite page. Along will come almost 100 pages of the most practical grinder operating information you ever saw.

Chapter XI

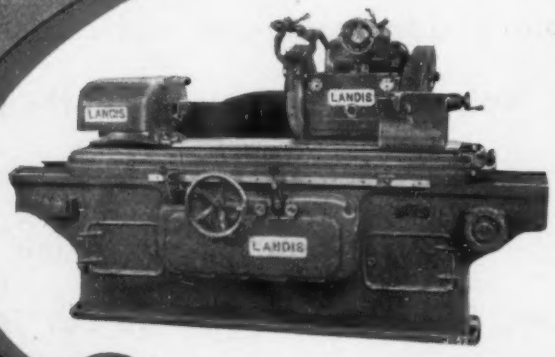
GRINDING WHEEL FEED

Too rapid feeding of the grinding wheel is a sin often committed, particularly when the operator is attempting to produce a fine finish. In the long run, time is saved by feeding the grinding wheel slowly and regularly and thereby building up a good finish from the start of the grind.

One of the most discouraging experiences that an operator can have is to find the work diameter varying from piece to piece for no apparent reason. Generally this will be found due to too much backlash in the wheel feed mechanism. Most grinding machines are provided with a means for taking up this excess backlash and this should always be checked into when there is an otherwise inexplainable variation in the accuracy of machine output.

Study each job carefully and work out the best method of grinding wheel feed for it. This will be far superior from the point of view of results than using the same method for all classes of work regardless of their individual characteristics. And finally, be sure to utilize the automatic wheel feed whenever possible.

Rapid or irregular feeding will cause the wheel to break down quickly and wear unevenly, which in turn makes it impossible to secure either accurate work or good finish.



THE LANDIS 14" - 18" TYPE C HYDRAULIC UNIVERSAL GRINDERS

- **Recommended for miscellaneous small lot production grinding, for certain classes of tool room work and for machine maintenance.**
- **Used by a vast number of war industries where the requirement is for a sturdy machine suitable for between center, internal and face grinding operations.**
- **Available in 14" and 18" swings and 36", 48" and 72" lengths.**

IF YOU HAVE A GRINDING PROBLEM

Let George do it

LANDIS TOOL COMPANY

George Grindit Says
"Improper feeding of the grinding wheel brings on what I call grinding indigestion. A few pills won't cure it. Good judgment will prevent it, however. So why not prevent it and the headache of having work rejected?"
PRECISION
LANDIS
GRINDERS

THE CHAPTERS

Work Centers and Centers in the Work . . Work Drivers and Driving Dogs . . Work Rests . . The Diamond . . Wheel Dressing and Wheel Truing . . Mounting and Balancing the Wheel . . Grinding Wheel Coolant . . Lubrication . . Multiple V Belt Drives . . Wheel Spindles and Bearings . . Grinding Wheel Feed . . Grinding Wheel Width . . Speed of Work Carriage Traversal . . Work Speed . . Grinding Wheel Speed . . The Grinding Wheel . . Chatter . . Miscellaneous Bits.

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Simplex Milwaukee Milling Machine—a compact, medium size machine for efficient production of smaller parts.

The machine tool industry has established new records in war production by producing machines in quantities without sacrificing accuracy and quality . . . Kearney & Trecker has developed many such machines, among them the M-Series Simplex—the newest machine in the bed type field.

It answers the demand for a medium-sized machine to efficiently produce the thousands of small parts vitally needed for planes, tanks and guns. Because its basic design is the same as the larger machines, it has strength and ruggedness to spare.

Milwaukee MACHINE

It's yours for the asking

"THE PROPER CARE OF MILLING MACHINE ARBORS"

So many of our customers have told us that the Kearney & Trecker arbor booklet provided the answer *to getting the utmost out of their present milling machines* — we'd like you to have a copy of it!

It tells how to —

1. Prolong Arbor Life
2. Maintain Precision and Trueness
3. Detect Distortion and Springing
4. Reduce Maintenance Costs
5. Secure Maximum Milling Efficiency

The back cover carries a SPEED CHART which can be cut out and placed next to the machine. It will show you at a glance what cutters to use on various materials, and the recommended speeds and feeds. For your copy write — Department AJ, Kearney & Trecker Corporation.

★ *Attention Educational Departments*

Are you faced with the problem of training milling machine operators? If so, we have the answer for you.

Kearney & Trecker has just completed a new visual training course titled "Milling Practice." It is composed of five, half-hour sound slide films dealing with the fundamental principles of milling for good machine tool performance.

You may obtain it on a rental basis or purchase it outright. Those firms who have seen "Milling Practice" acclaim it to be the best of its kind ever offered to industry. For further details write . . . The Department of Industrial Education, Kearney & Trecker Corporation.

KEARNEY & TRECKER CORPORATION
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To help you produce and deliver more—to aid you in getting the most efficient results out of tools and materials — we will offer from time to time, useful information in printed form on milling machine operation. This is intended mainly for those of your men who are not so familiar with these facts.

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ON ALL STANDARD SIZES

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IMMEDIATE SHIPMENT of Thread Plug Gages in all standard sizes can now be made on orders for any normal quantity.

In case any sizes are not in stock at the time your order is received, the delay in shipment will be hardly more than a day or two, as we manufacture thread plug and ring gages exclusively, and carry an unusually complete stock at all times.

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CADILLAC THREAD GAGES CADILLAC

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CADILLAC GAGE COMPANY, *Detroit*

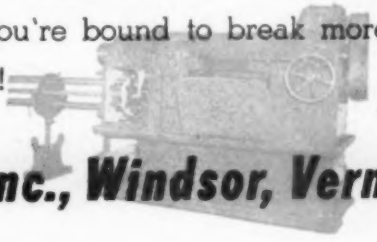
PHOTO COURTESY THE HOSDREG CO., INC., HUNTINGTON, INDIANA

SHE'S GINNY CLOSE—21 years old—95 pounds—married—member of the 10% Club—she's a WOW*. In fact she's the smallest multiple spindle automatic lathe operator in the world.

But she holds a more important record—2286 shells produced in 8 hours with the help of her 8-spindle Conomatic. She does her own tool setting, loads the machine with stock, beats the boys at their own game, then takes care of her six room house, and feeds 100 chickens and a farmer husband.

The Hosdreg Company is pretty proud of Ginny, with her cheerful attitude and happy smile—and also proud of their Conomatics, with their easy operating features and outstanding production capabilities. Get a WOW like Ginny and a Conomatic on the job, and you're bound to break more than one record!

* Woman Ordnance Worker



CONE Automatic Machine Company, Inc., Windsor, Vermont

You can't make TOMORROW'S PRODUCTS *with*

YESTERDAY'S EQUIPMENT!

EVEN though postwar demands for all kinds of goods will be heavy, selling will still be competitive. People with money in the bank or in their pockets will still want the best they can buy for that money. Retailers and wholesalers must still have a profit margin. Manufacturers, therefore, will need to look at their costs more keenly than ever before.

To maintain our American standards of living, low machine-power costs must be balanced against higher man power rates. This means that the most modern machines, designed to turn out more and better work, must replace equipment that has worn out or been outmoded during the War period. Wherever possible, automatic operation must replace manual operation. New products and new materials will call for new tools. Many developments which have grown out of the war will be applied to postwar production. So, few manufacturers can say, with safety, that they can get along very well with their present mechanical equipment.

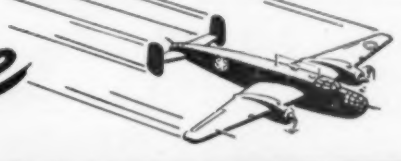
It is time now to start to study that equipment, with an eye to the future. Wise manufacturers are already fine-combing their plants, marking for sale or for scrap those machines which will no longer have a place in their postwar production. They are setting up reserves to permit the replacing of these machines by new, faster, better tools that are sure to be available, when war production pressure is off.

Monarch will be among those manufacturers which will have new developments to offer you, at that time. We have learned many lessons from wartime users of Monarch Lathes. These lessons are even now being assorted and studied, to determine how they can be used to improve Monarch Lathes, to help make more goods, for more people, at lower cost.

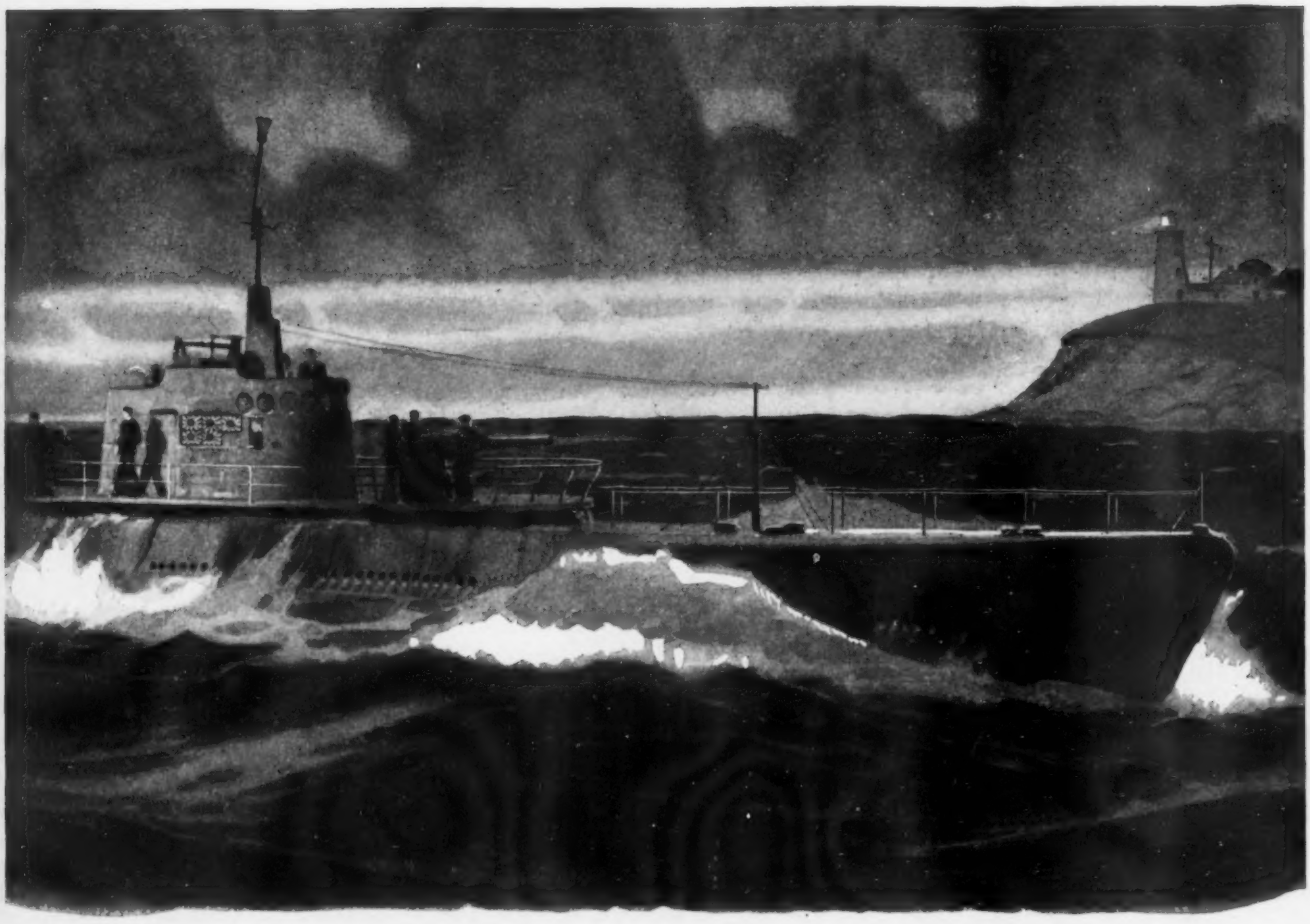
THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

MONARCH LATHES

Save Time



BACK FOR MORE TORPEDOES



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P&H HEVI-LIFT HOISTS

ARMY E NAVY

A new star has been added to P&H's award for excellence in war production.

"Ready? Hoist! We'll show 'em a thing or two about production. And hang up some records they can't forget."

But for war, they might never see the inside of an industrial plant. But here they are—thousands of older men and women—giving their best to overcome lack of experience—to keep faith with our fighting forces—to make sure that vital supplies are neither too little nor too late.

As these new workers take the places of experienced men, more and more Hevi-Lift Hoists are joining them to facilitate the handling of heavy loads on and off machine tools, along assembly lines, in shipping departments and loading zones—wherever fast handling can lessen labor, save time, and speed the war effort.

P&H HEVI-LIFT HOISTS

Built in capacities up to 15 tons. Five-step variable speed push-button control is available for lifting, lowering or horizontal trolley travel. Write for literature.

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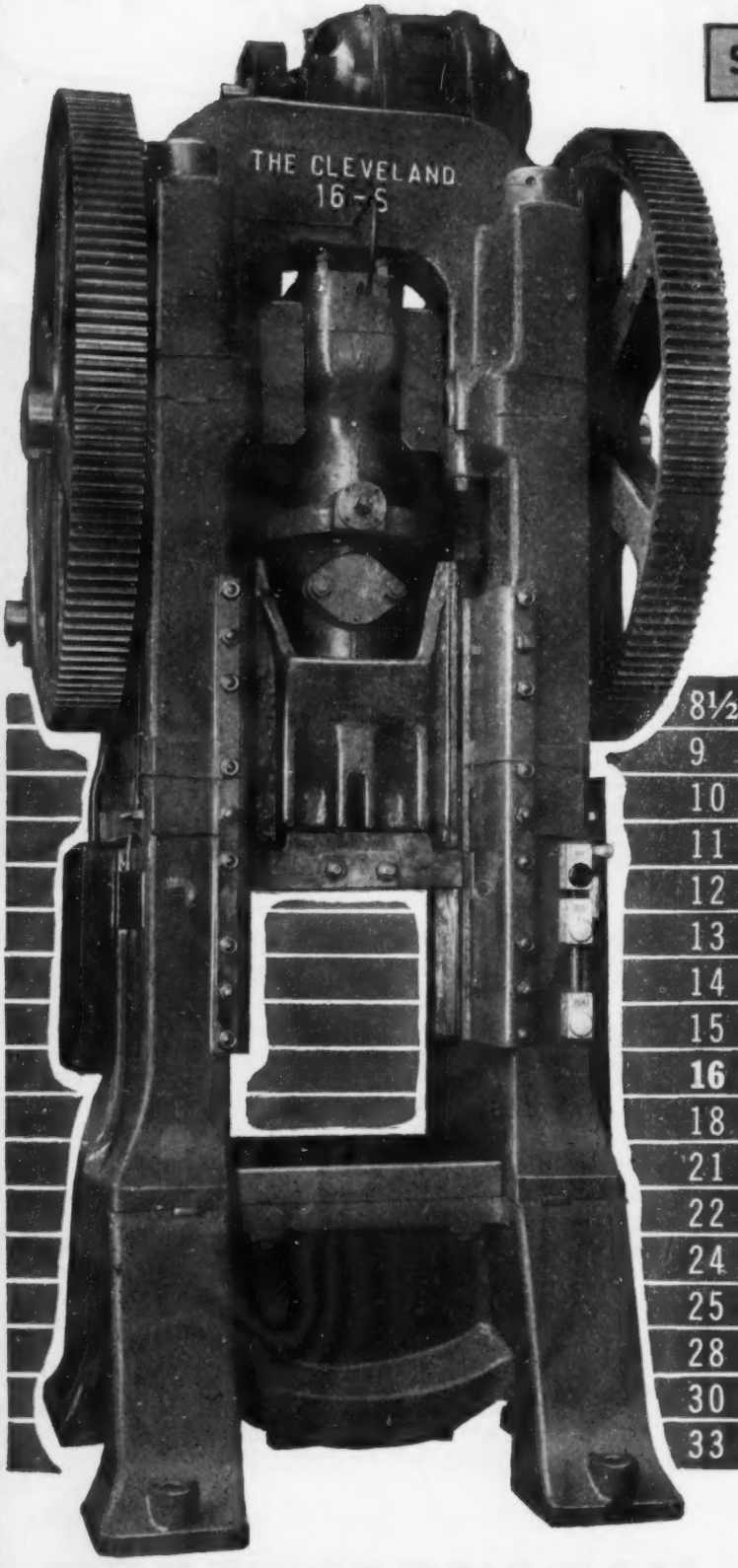
CLEVELAND *Straight Sided*



PRESSES

From 60 to 1300 Tons Capacity

8½ S	60 Tons
9 S	72 "
10 S	90 "
11 S	110 "
12 S	130 "
13 S	150 "
14 S	180 "
15 S	215 "
16 S	**255 "**
18 S	345 "
21 S	500 "
22 S	550 "
24 S	665 "
25 S	750 "
28 S	925 "
30 S	1070 "
33 S	1300 "

Cleveland Straight Sided Single Crank Presses can be furnished in a wide range of sizes with capacities from 60 Tons to 1300 Tons and in most cases the stroke, adjustment, bed area, etc. can be modified to suit particular requirements.

These Cleveland Presses are ruggedly and accurately constructed and are provided with extra long slides supported in carefully fitted gibs which allow ample bearing surface for the slide even when it is at the extreme end of its stroke.

The four piece steel tie rod type of construction consists of a base, two uprights and a crown, securely held together by four massive steel tie rods which, also take the stress usually transmitted to the frames of the one-piece type of Presses.

In the larger sizes, twin drive of the crankshaft is usually employed to prevent undue torsional strain on the crankshaft.

The Press illustrated is a 16 S, twin drive, double geared equipped with a single station electrically controlled, air operated friction clutch and brake. The Press has a capacity of 255 tons and operates at 16 strokes per minute.

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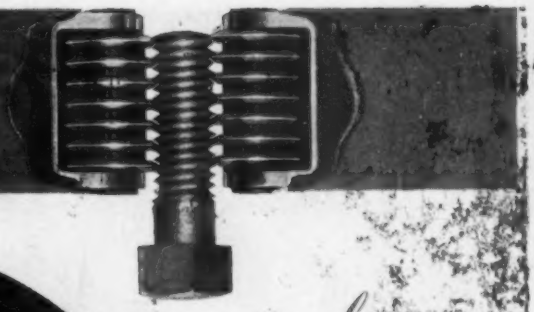

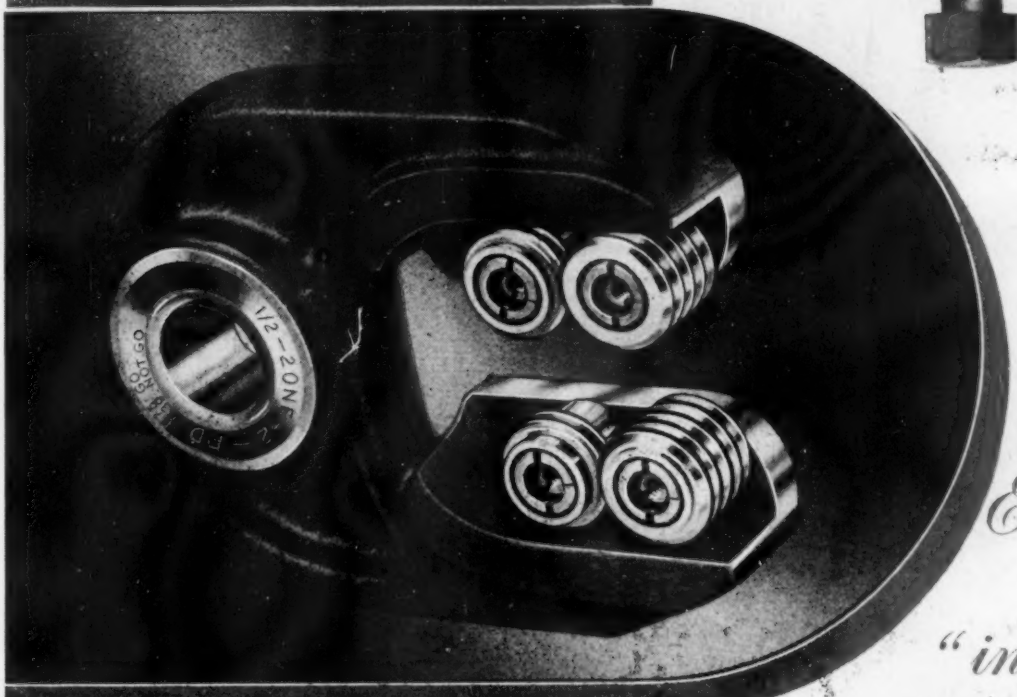

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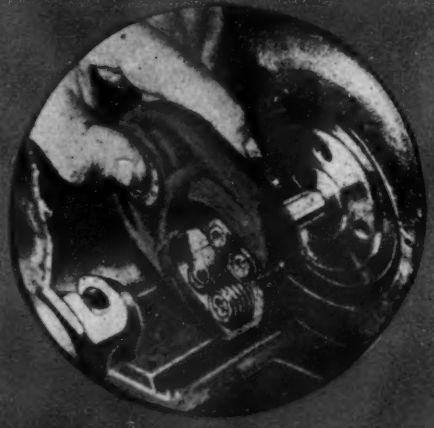
ROLL THREAD SNAP GAGES



GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASSACHUSETTS

Detroit Plant: 5850 Second Blvd.

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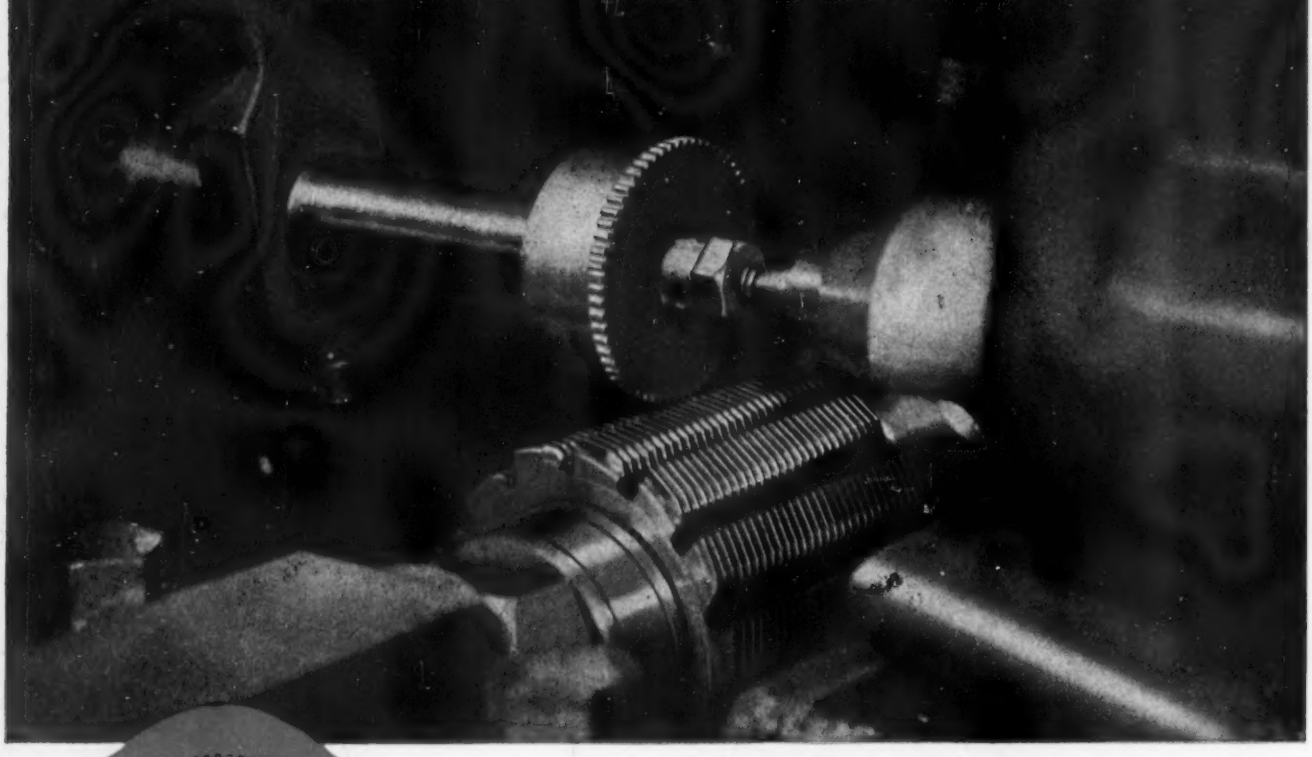
The Roll Thread type of Snap Gage is ideal for gaging work on the machine. Its open end construction permits rapid application of the gage to the threaded part. The rotating rolls increase the life of the gaging ribs and the effective life of the gage.

Now you can get Roll Thread Snap Gages from "*Greenfield*," the source you've always looked to for quality gages to guard the accuracy of your product. Send at once for descriptive booklet, giving complete information, and instructions for ordering Roll Thread Snap Gages.

GTD GREENFIELD

TAPS • • • DIES • • • GAGES • • • TWIST DRILLS • • • SCREW PLATES

HOBBING A SMALL, ACCURATE GEAR FEATURING FINE FINISH AND QUIET RUNNING ABILITY



ON A BARBER-COLMAN No. 3 HOBBING MACHINE

These illustrations show a close-up of the hobbing operation, and one of the finished pieces, of a shutter gear used in a prominent make of a movie sound projector. No picture could show how quietly this gear runs, nor is it practical to photograph the fine finish and accuracy which makes it so quiet. These important qualities are indicated by sensitive test instruments, but the final test is the satisfaction expressed by thousands of users of the projector, and by its ability to produce clear, brilliant, flickerless movies. A Barber-Colman No. 3 Hobbing Machine is used to generate the teeth on this shutter gear, because this machine has demonstrated its ability to produce gears that must meet exacting specifications. For example, this gear is held to less than .001″ backlash, and a pair of them must roll within .0005″ on pitch diameter as well as rotate freely under any conditions in a gravity feed test instrument. For consistent, high-quality accuracy and finish, on production work, use Barber-Colman Hobbing Machines.

SET-UP OF THIS JOB

Piece — Movie projector shutter gear.

Material — Aluminum alloy.

Dimensions — 1.280″ O.D. .080″ face, 62 teeth, 50 pitch spur form.

Machine Set-up — feed .008″ per rev. of work, hob speed 388 r. p. m. paraffin oil cutting fluid.

Production — approximately 60 gears in 10 hours.

Hob — B-C 1 7/8″ x 1 7/8″ x taper hole. Produced 200 pieces per setting and 1000 pieces per sharpening.

Piece is clamped on special arbor and held between centers.

Note burring tool attachment.

HAND BOOK "L"

How can you get maximum life from hobs? One important factor is proper sharpening, which is thoroughly covered in a special section of the new Barber-Colman Handbook "L", pages 271-282. This book is available when requested on company letterhead signed by person in key position.

Buy War Bonds

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HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

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Prompt Delivery? **Yes!**
But with Strict Adherence to Accuracy on "STANDARD" *Seasoned*

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THE ACCURACY and economy of "STANDARD" Plug Gages is a byword and a "buy word" wherever precision parts are made. Even in today's constant clamor for *SPEED*, the material, craftsmanship and accuracy of "STANDARD" Gages are faithfully maintained.

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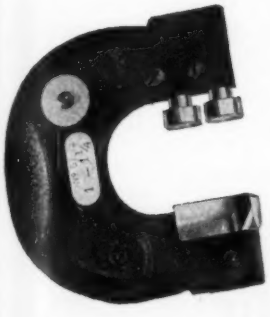
Salvage worn Plug and Ring Gages, save vital gage steel and conserve man and machine time with Hard Chrome Plating by STANDARD. Applied to new Gages as well as to Gages worn below original size, their life is increased 3 to 5 times.

STANDARD

Snap Gages



SNAP GAGES designed for ease in handling and speed in inspection. "STANDARD" Snap Gages are *standard* equipment for fast, precise war production. Constant analysis of materials and precision inspection at every stage of their manufacture insure the quality, stamina and accuracy of these *standard* "STANDARD" products.

SUPER *Snap Gages*

AN IMPROVED Snap Gage with spherical gaging pins that eliminate out-of-parallelism. Easily set, it requires no simultaneous adjustment to a given dimension and to parallelism. SUPER Snap Gage simplifies inspection, speeds production, insures greater accuracy and facilitates setting to closer tolerances. Write for special bulletin.

Complete Stocks Ready for Immediate Shipment

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In the new CINCINNATI *Foundry-*

every ounce of metal poured is *Meehanite*

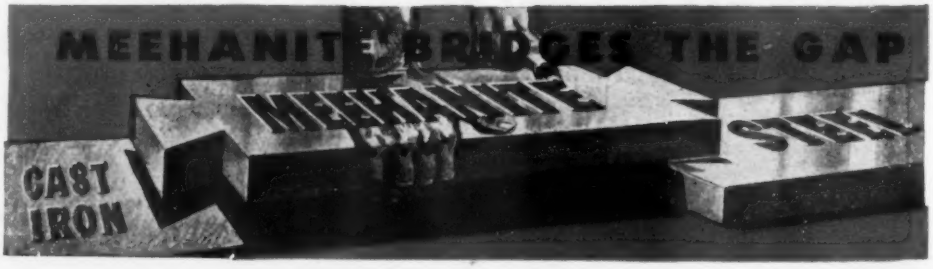
Hailed as the country's most modern foundry for handling castings in a variety of sizes and shapes on a production basis, the new foundry of The Cincinnati Milling Machine Company was planned for the most advanced metallurgical practices. It is equipped with machinery representing the last word in mechanical perfection, and crystallizes the best thinking, experience and planning in foundry work.

The fact that only Meehanite is made here is a tribute to this versatile cast metal. Made in several types to suit different services, Meehanite fulfills the various requirements of The Cincinnati Milling Machine Company, and Cincinnati Grinders, Incorporated.

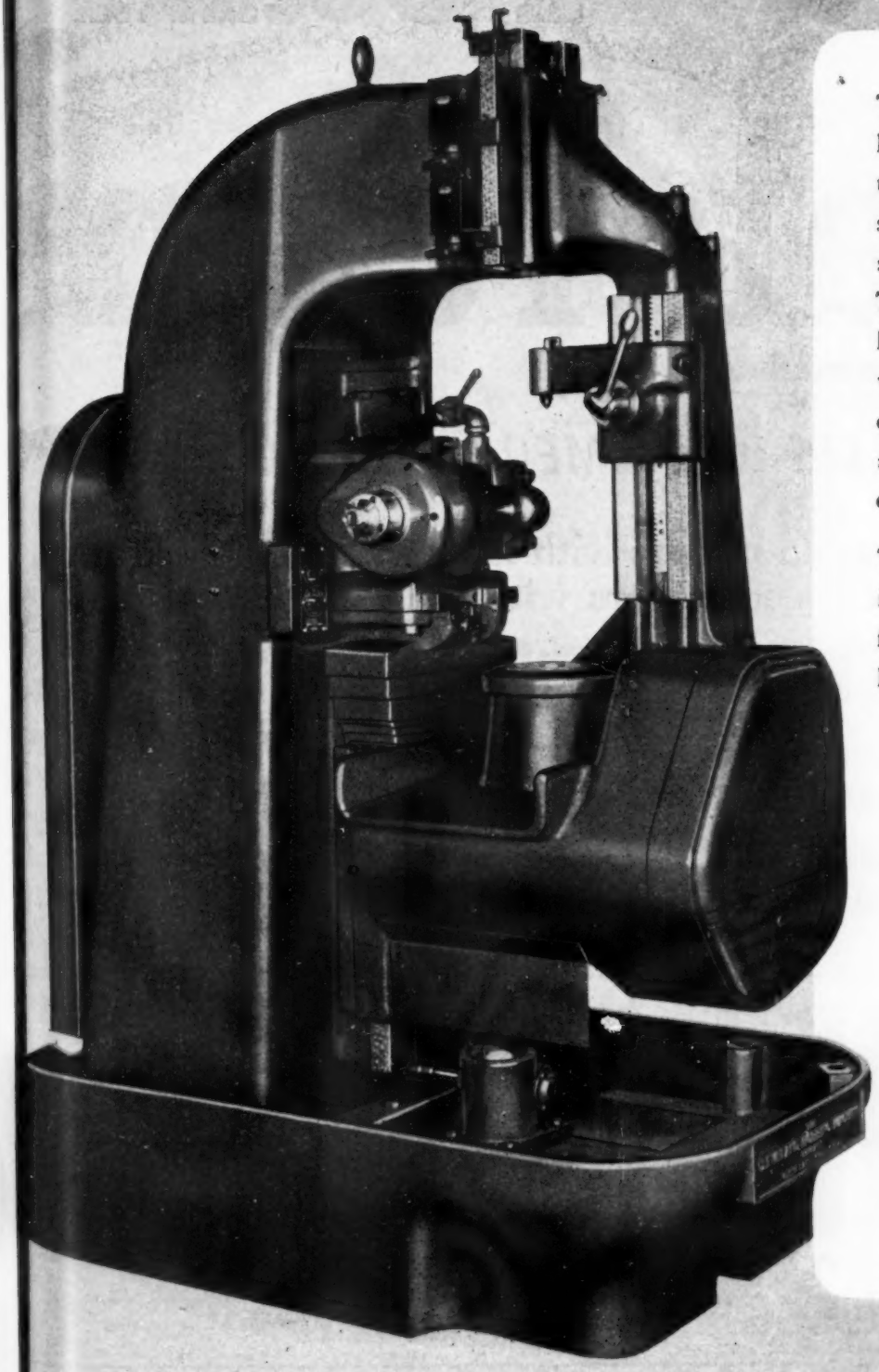
Included in the services for which the most popular types of Meehanite are made are: high strength applications; resistance to wear and heat. Meehanite Castings are readily machinable, have high vibration absorption properties, are dependably uniform in structure.

Write for Bulletin No. 9—"Meehanite the Metal for Machine Tool Castings."

MEEHANITE RESEARCH INSTITUTE, New Rochelle, N. Y.



Hobs GEARS *and* SPLINES *Accurately*
THE RIGIDHOBBER



The Rigidhobber presents a high production method for the accurate duplication of spur and helical gears—straight and helical splines. The rigid support to the work-head both above and below work eliminates spring in either work or hob and assures dependable precision of all work.

The Rigidhobber is also built in the 8 spindle rotary model for the mass production of highly accurate work.

This bulletin tells all about Rigidhobbers–what they are –how made–and how they can help you reduce costs.

The CLEVELAND HOBBING
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BUILDERS OF RIGIDHOBBERS AND RIGIDTHREADERS

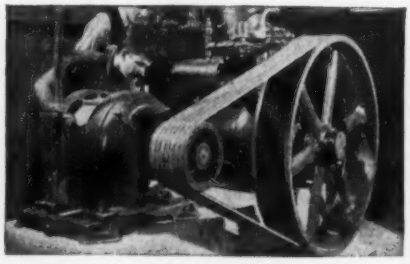
Good Team Great Team

ALLIS-CHALMERS MOTORS AND

☛ **Using high-speed motors with Allis-Chalmers Texrope Drives and single-speed motors with Allis-Chalmers Vari-Pitch Sheaves and Speed Changers has always been good practise.** ***In time of war it's a vital practise!***

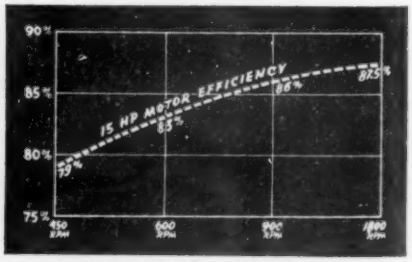
☛ **Such combinations give sharply higher efficiencies—at lower cost in man-hours, money and materials!**

☛ **Allis-Chalmers, only builder of *both* motors and V-belt drives, offers invaluable know-how in teaming them up.**



1 In most applications, an 1800 rpm motor with Texrope Drive will ably do the job of a lower-speed, direct-connected motor —at lower cost in money *and materials!*

2 When you buy an 1800 rpm instead of 450 rpm 15 hp squirrel-cage motor, for example, 600 lb are saved. And *you* save well over $200 — with drive figured in!



3 Note that efficiency rises from 79% for the 450 rpm motor to 87.5% for the 1800 rpm motor. The 1800 rpm motor saves you over 30 kw/24 hr. day.

WE WORK FOR VICTORY — WE PLAN FOR PEACE

ALLIS-

in Peace . . . in Wartime!

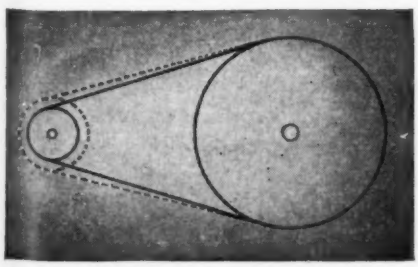
TEXROPE DRIVES

IT'S TIME to take a *fresh* look at motor buying! See below how much you can save with high- and single-speed motors made flexible by Texrope Drives.

Allis-Chalmers, builder of Lo-Maintenance Motors, originated the multiple V-belt drive and Vari-Pitch Sheaves . . . is the only manufacturer building *both* motors and V-belt drives. You benefit when you ask for — and get — the *right* combination of Lo-Maintenance Motor and Texrope Drive!

Call on your nearby Allis-Chalmers district office for facts, figures and advice — or write direct to ALLIS-CHALMERS MFG. CO., Milwaukee 1, Wis.

A 1627



4 Infrequently needed speed changes can be had by changing from one size motor sheave to another. Juggling *complete* drives, range is 1:1 to 7:1.

5 With the Allis-Chalmers Vari-Pitch Sheave, you can increase or decrease speed by adjusting sheave diameter . . . obtaining an *unbroken* series of speeds!

6 Allis-Chalmers Vari-Pitch Speed Changer gives you infinite changes at the turn of a wheel — within 3.75 to 1. It's compact, flexible, *efficient!*

ALLIS-CHALMERS

LO-MAINTENANCE MOTORS
TEXROPE DRIVES

A Letter from Guadalcanal...

In a recent letter from a lad at Guadalcanal to his former employer was voiced the greatest challenge of our time.

"What," he said, "am I, and all these fellows with me, going to do when this thing is over?" Is peace to bring with it the deadly spiral: men laid off and demobilized, hence less purchasing power, hence more plants closed down, hence more men laid off, hence — ?

We believe we've seen the answer right on the production lines and right in the post-war plans of American industry.

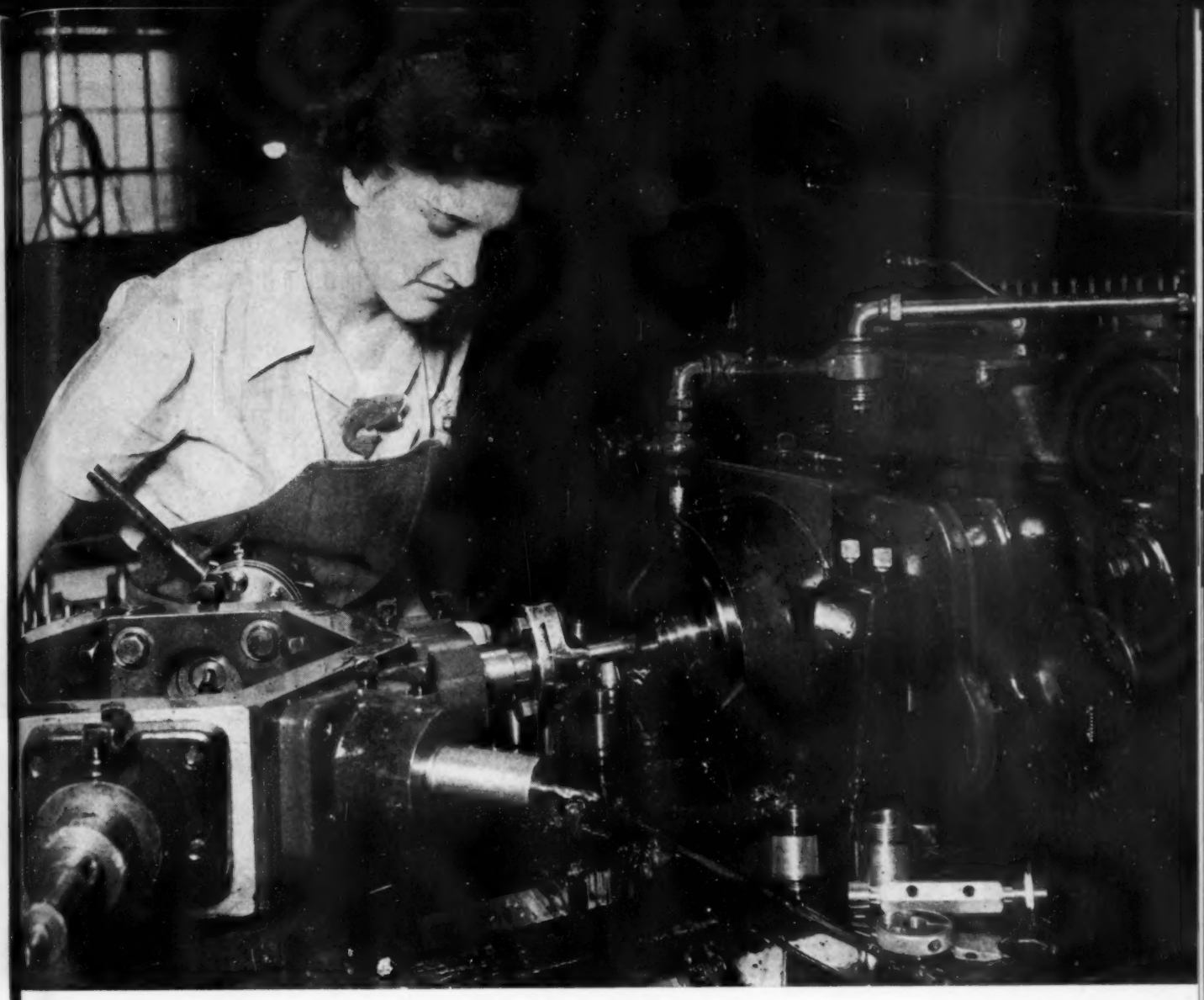
We've seen and consulted with hundreds of research men uncovering new secrets in metallurgy, synthetics, plastics, aeronautics — finding new techniques and economies — planning new and wonderful products that will cushion the post-war interim to the greatest production age in history.

As internal grinding specialists, we at Bryant have already helped to solve production problems involving the machining of many new light metals, alloys, and synthetic materials including glass, plastics, hard rubber, wood, graphite, and even machine parts made of paper.

We've developed many new techniques in tooling, and we believe that this knowledge is important to your future. For that reason, our Consulting Service is available at all times. Call upon us now!

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.



ACME

6W TURRET LATHES

Respond to the delicate touch of women operators

• With the major portion of available man power required on our widely scattered battle fronts — the trained hands of women are skillfully handling precision work in many of our war plants today.

Precision parts being produced here by Women Operators is not a difficult job on the Acme Way Type Turret Lathe shown. The ease of operation — convenience and simplicity of control and flexibility of Acme Turret Lathes enables women to quickly pick up the fine points of operation of this accurate Turret Lathe.

Investigate Acme Turret Lathes for your vital war work with full confidence that women operators can handle them and help you in replacing men now needed in our armed forces.

Consult Cincinnati Acme on your Turret Lathe requirements.

The ACME MACHINE TOOL CO.,
CINCINNATI, OHIO

Colonel Stevens wants to grind a crankshaft

HEADQUARTERS
SERVICES OF SUPPLY
EUROPEAN THEATER OF OPERATIONS
UNITED STATES ARMY
ORDNANCE SECTION

12 June 1943

Norton Company
Worcester
Mass., U.S.A.

Gentlemen,

What equipment can you supply for the regrinding of line bearings, crankpins and the reconditioning of other parts incidental to the overhaul of engines used in motor transport and ground combat equipment?

Please forward to the address below available catalogues on this and similar types of equipment manufactured by your company.

Very truly yours,

R W Price
for

E. Clarence Stevens
Colonel, Ordnance,
Engineering Division,
Hqs. SOS, [redacted]
U. S. Army
% Postmaster, New York, N.Y.

GRINDERGRAM

The chief purpose of a grinding lubricant or coolant is to dissipate the heat generated in grinding. It is not intended to either reduce friction or affect the cutting action between the wheel and the work.

NORTON *and*

NORTON REPRESENTATIVES

are available on every continent to give practical help

IN effect we say to Colonel Stevens, "Right in the neighborhood of your own motor equipment park, you'll be able to get information on Norton machines".

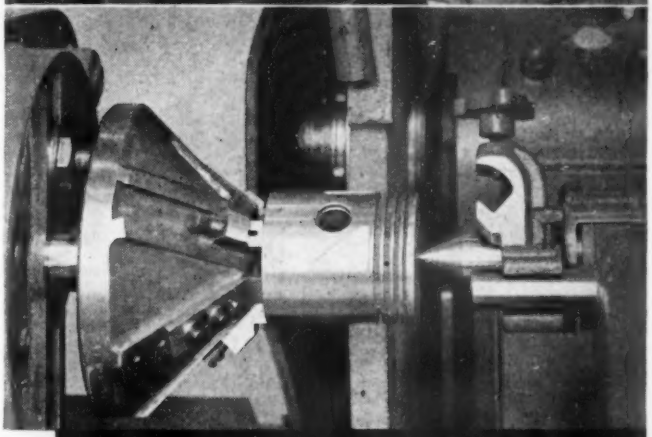
For in practically every country where American troops are based, as is the case throughout the United States, there are Norton representatives — agents with large well-trained organizations, men with technical information on Norton grinding machines and with experience in their operation.

Of course we immediately sent to Colonel Stevens, by air mail, complete catalog information covering the extensive line of Norton crankpin, crankshaft and piston grinders, as well as on the specialized Norton Autopart Regrinding machine.

But most important we included a list of our active dealers in Europe, Africa and Australasia who can show Colonel Stevens, wherever he may be, Norton machines on the production line, many of them close to the fighting fronts.

NORTON COMPANY
WORCESTER 6, MASS.

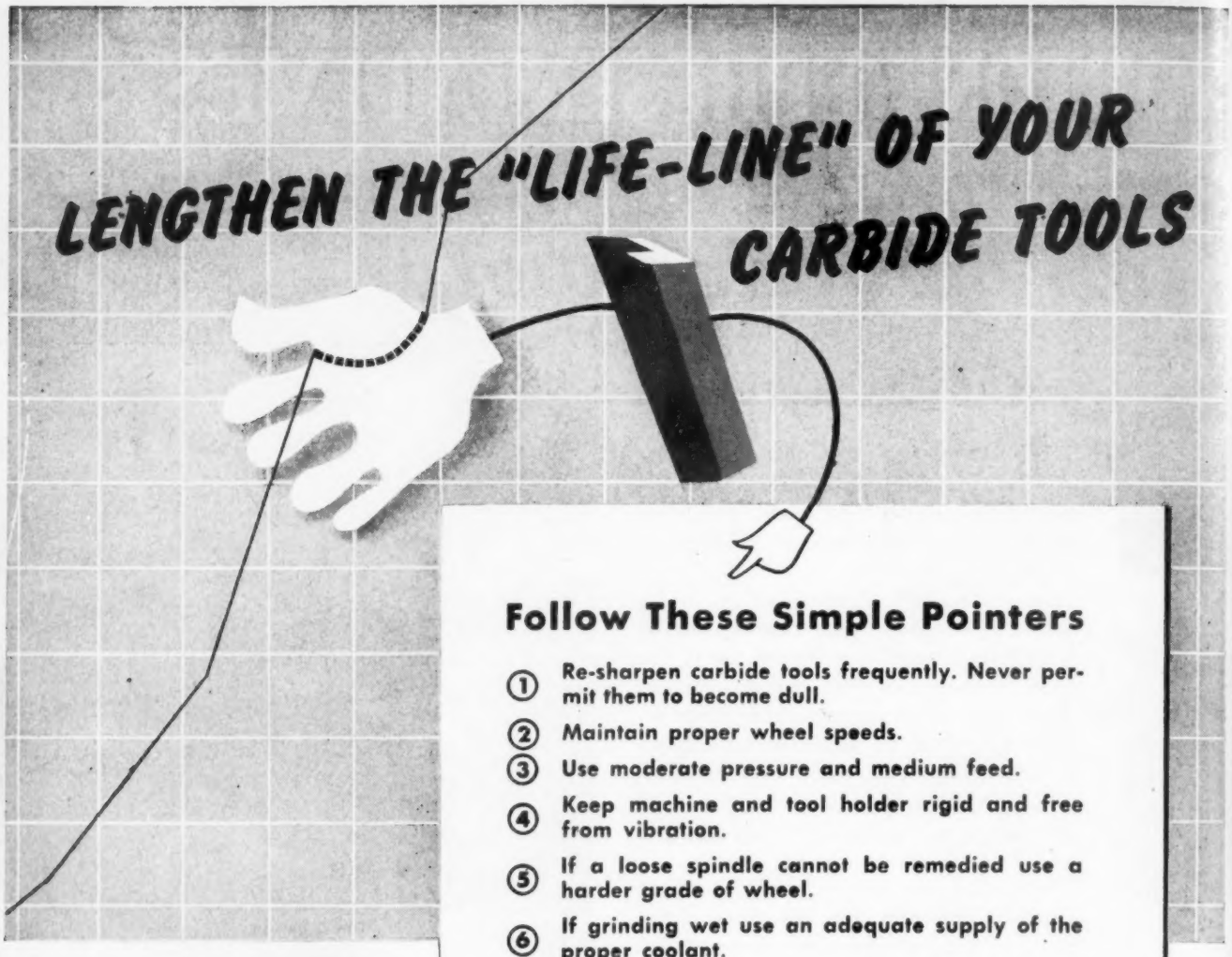
M-463



THE NORTON AUTOPART GRINDER is a versatile machine — ideal for repair depots. It handles a variety of cylindrical work, both plunge cut and traverse, in addition to the regrinding of crankshafts (top) and pistons (bottom).

GRINDERS
Lappers

LENGTHEN THE "LIFE-LINE" OF YOUR CARBIDE TOOLS



Follow These Simple Pointers

1. Re-sharpen carbide tools frequently. Never permit them to become dull.
2. Maintain proper wheel speeds.
3. Use moderate pressure and medium feed.
4. Keep machine and tool holder rigid and free from vibration.
5. If a loose spindle cannot be remedied use a harder grade of wheel.
6. If grinding wet use an adequate supply of the proper coolant.
7. If grinding dry do not over-heat the carbide tip.
8. Never cool a carbide tip by immersing it in water or other coolant.

9

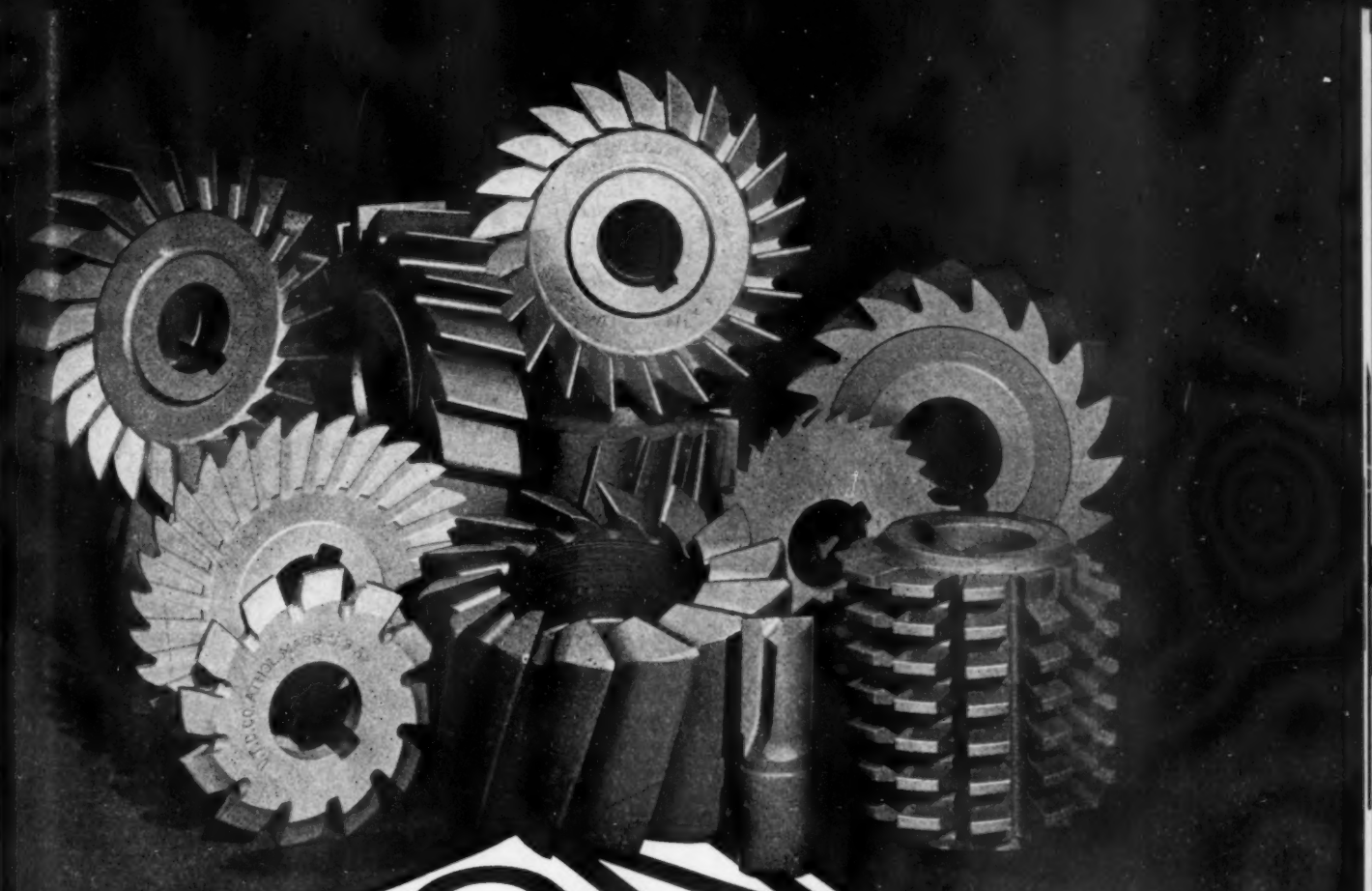
USE MID-WEST "B" BOND WHEELS FOR ALL CARBIDE TOOL GRINDING.

MID-WEST engineers will be glad to help you select *exactly* the right "B" Bond wheels for your grinding room. **MID-WEST** "B" Bond wheels are manufactured in any grain and any grade, porous or dense. Reasonably prompt delivery.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. Milwaukee Ave. **Detroit 11, Mich.**



UNION

Maintain accuracy with fewer production delays! Every tool in the Union line incorporates features of design and construction based on our continuous research into tooth design, the cutting properties of tool steels, the characteristics of the newest metals and alloys and all other factors affecting efficiency in metal-working. The results of Union research are readily apparent in the longer lasting accuracy of every Union Tool . . . in the maximum production obtained from every machine that is Union-equipped.

UNION TWIST DRILL CO., ATHOL, MASS.

UNION TWIST DRILL CO.
ATHOL, MASS.

S. W. Card Mfg. Co. Div., Mansfield, Mass.
Butterfield Div., Derby Line, Vt.
Butterfield Div., Rock Island, Quebec.

STORES

New York: 61 Reade St.
Chicago: 11 So. Clinton St.
Detroit: 6548 Antoine St.
San Francisco: 121 Second St.
Los Angeles: 524 E. Fourth St.
Seattle: 568 First Ave., South.

Divisions of the
UNION TWIST DRILL CO.

UNION BUTTERFIELD CARD

Butterfield

"THRED-RITE" DIES

The adjustable collet die at its best! The result of Butterfield's intensive research into ways to improve the tools of modern production. "THRED RITE" Dies are simple in construction, easy to assemble and quickly adjustable to split 0.001". Full floating construction assures accurately centered work. Where speed is imperative—and the going tough—put "THRED-RITE" Dies on the job!

Divisions of the
UNION TWIST DRILL CO.

BUTTERFIELD DIVISION
DERBY LINE, VT. **ROCK ISLAND, QUE.**

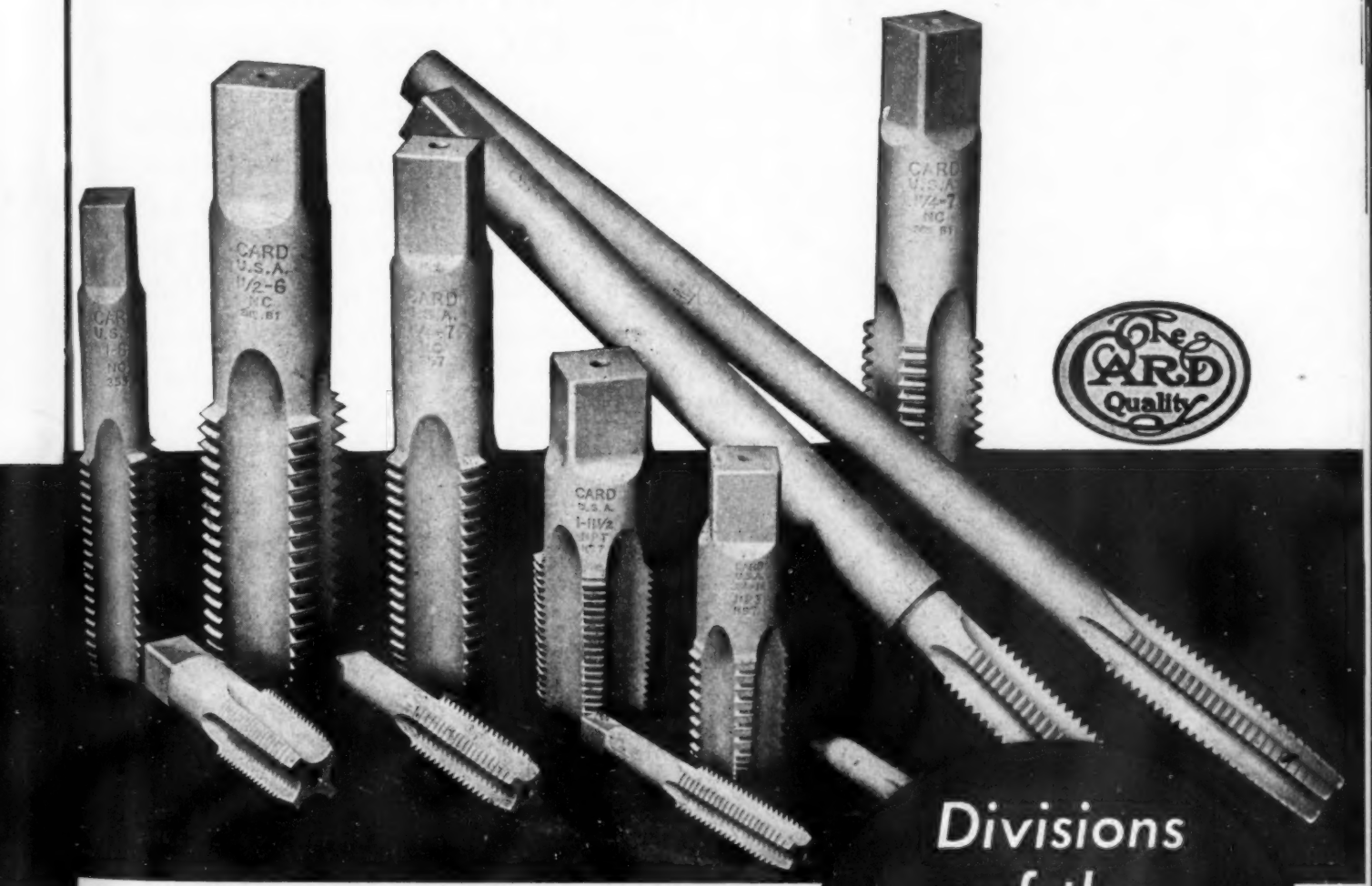
STORES: New York, 61 Read St. Chicago, 11 So. Clinton St. Cleveland, Hal. W. Reynolds, 3346 Superior Ave. Detroit, 6540 Antoine St. Los Angeles, 524 E. Fourth St. Toronto, 137 Wellington St. West. Montreal, 111 St. Paul St., West. Winnipeg, 403 Travellers Bldg. Vancouver, 327 Shelly Bldg. Agents for Great Britain—Charles Churchill & Co., Ltd., 27-34 Walnut Tree Walk, Kennington, London, S. E. 11, England. Branches at Birmingham, Manchester, Glasgow, Newcastle-on-Tyne and Bristol.

UNION BUTTERFIELD CAR

QUALITY CARD TAPS

FOR EFFICIENT WARTIME SERVICE

The Card Emblem has always been a reliable guide to efficient tools for producing accurate threads, and present war production demands find Card ready with tools to do today's vital tapping jobs. In plants engaged in top-speed war production, **results** are proving the wisdom of using the Card Emblem as a guide to real tap service!



S. W. CARD MFG. CO.
MANSFIELD, MASS.

STORES

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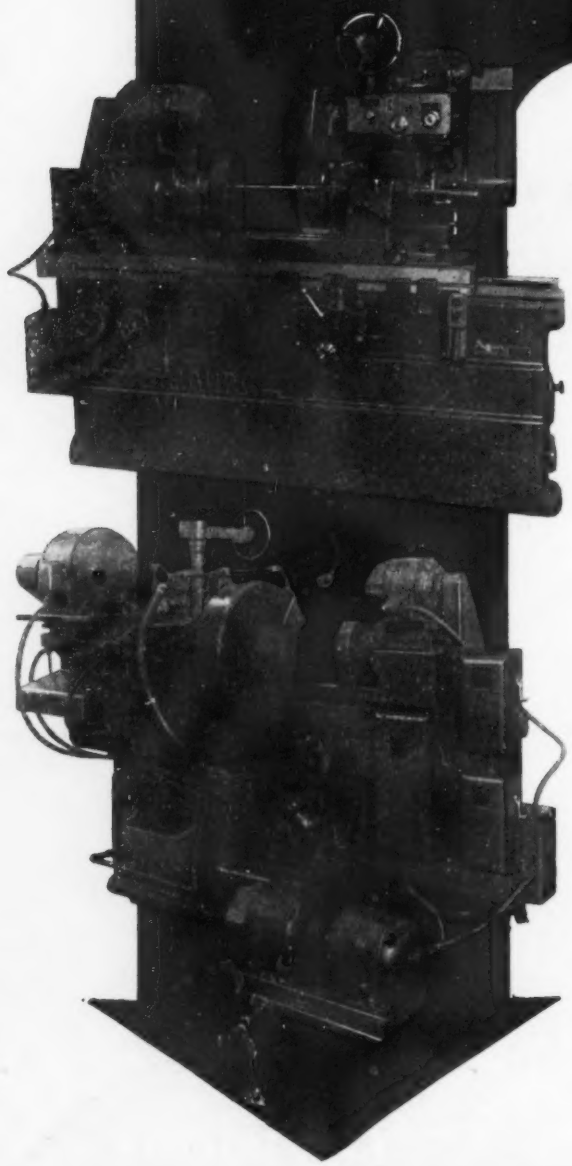
Seattle: 568 First Ave., South

Divisions of the
UNION TWIST DRILL CO.

UNION BUTTERFIELD CARD

A New FITCHBURG GRINDER



NEW IMPROVED FITCHBURG TYPE-B 10" PLAIN CYLINDRICAL AUTOMATIC PRECISION GRINDER

The Fitchburg Type-B Plain Cylindrical Automatic Precision Grinder has been improved — into this new Type-B has been built new features for increased work production, greater accuracy, and finer finish.

New improved controls increase the ease of operation — push button controls are all located at the operator's finger tips.

It handles a wide range, and a number of types of jobs (up to 10 inch swing), and the automatic precision features leave the machine operator free to operate a second machine — *thus cutting man-hour cost on every piece produced.*

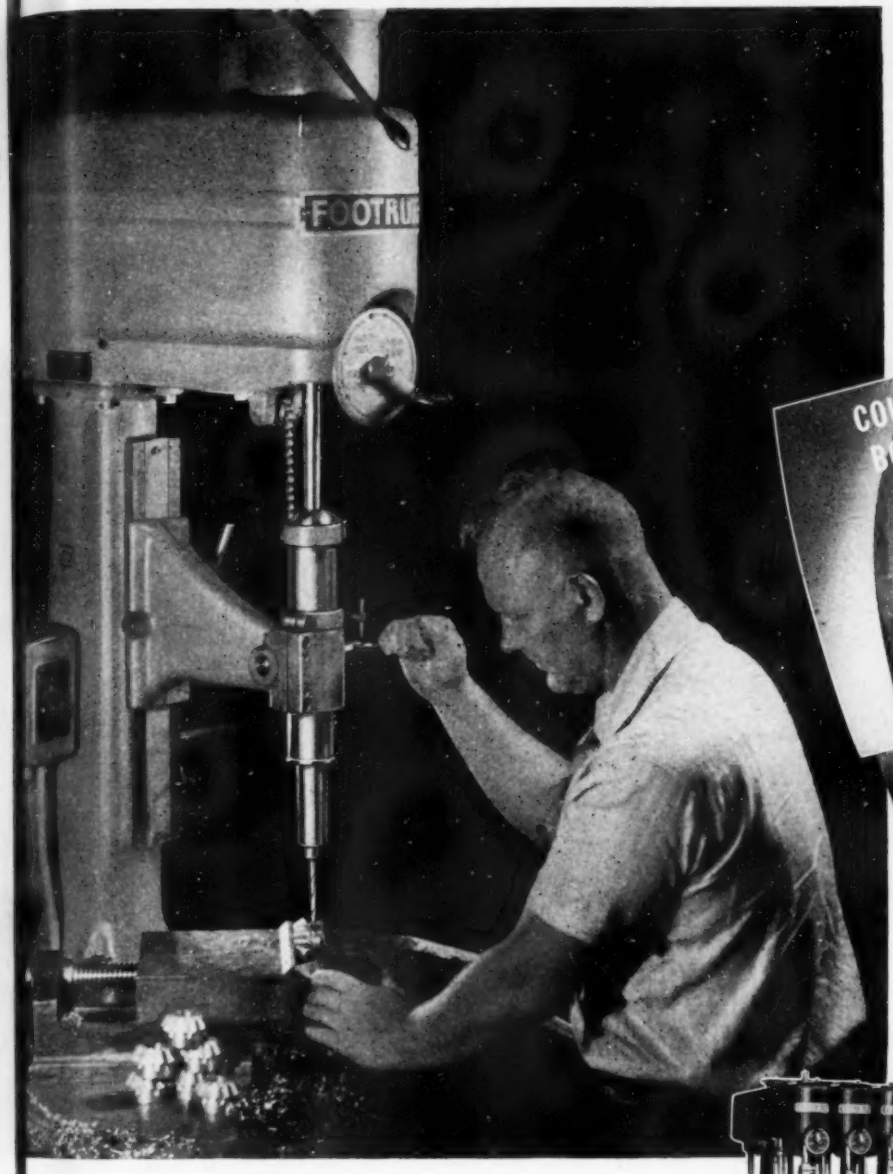
Write today for complete details and information.

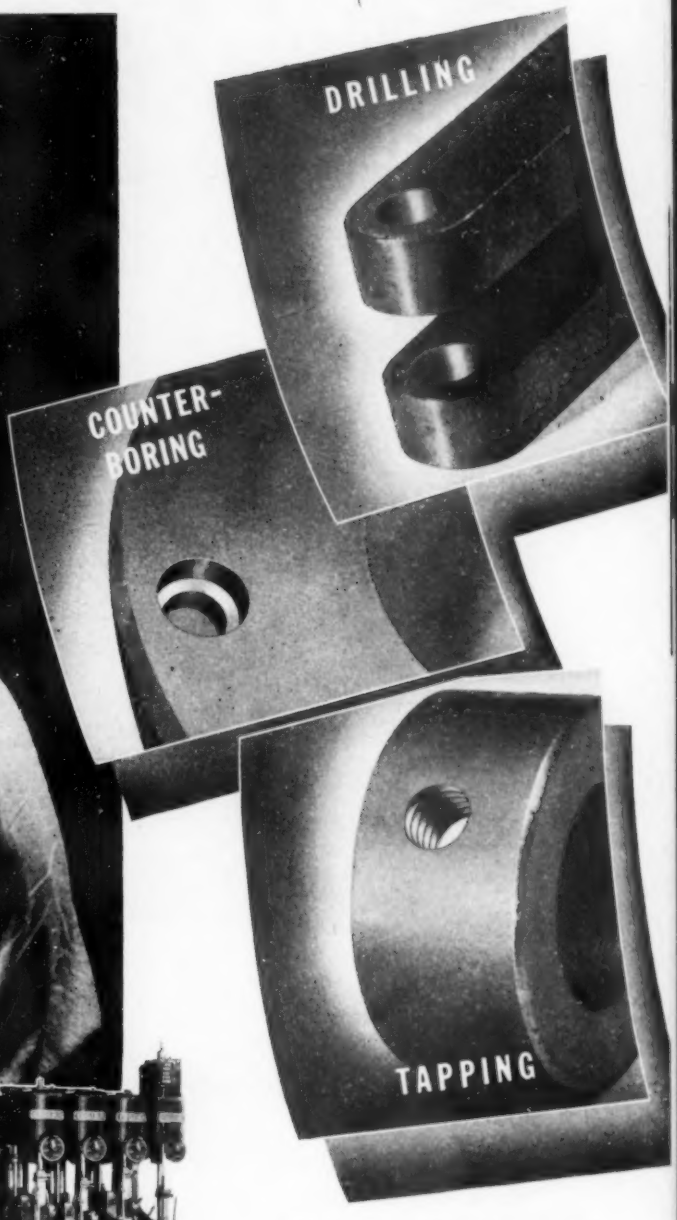
FITCHBURG GRINDING MACHINE CORP.

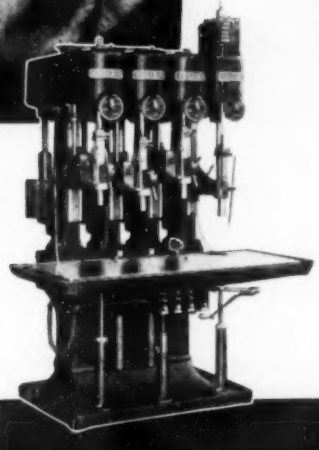
FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

FASTER WAR PRODUCTION!







• The choice of fine machine tools now will help you meet those new production schedules needed to win the war. • Footburt sensitives are built with the wide range of speeds and with the power and sturdiness to drive cutting tools to their full capacity. They are built with the care and precision that will keep them accurate over a long period. • Write, wire or phone for prices and delivery information.

THE FOOTE-BURT COMPANY • Cleveland, Ohio

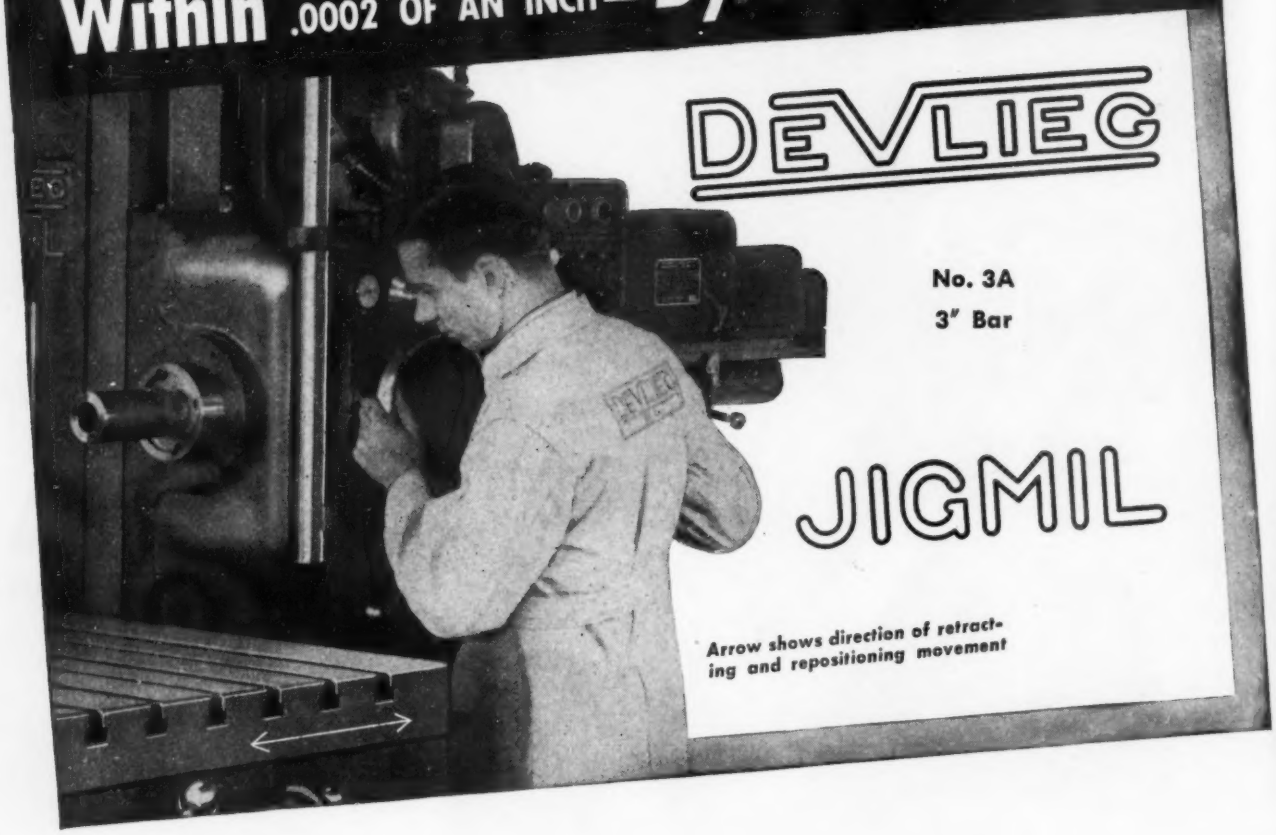
Detroit Office: General Motors Building

No. 2 MACHINE WITH BACK GEAR

8" or 12" Overhang • ⅝"Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 R.P.M. • 280 to 3450 R. P. M. • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit

FOOTBURT
Sensitive
DRILLING MACHINES

Retracting and Repositioning Work Within .0002 OF AN INCH—By Push Button



The most frequently needed function in a precision boring machine is that of retracting the work to facilitate measuring and tool setting.

In the DeVlieg Jigmil, this function is automatic—by fingertip control. Operation of a push button unlocks the table and moves it by rapid traverse to the desired position for measuring. For repositioning, operation of a single push button will cause the table to return to its cutting position by rapid traverse, stopping and locking automatically. Uniformity of selected position for stopping and locking is dependable within .0002".

The DeVlieg Jigmil is a new type machine—has the spacing accuracy of a Jig Borer—Performance Qualities of a Milling Machine—Convenience and Flexibility of a Horizontal Boring Mill. All control is so centered and organized that the operator never has to take his eyes off the work.

Thus, the Jigmil fulfills the machine tool ideal—a powerful and accurate extension of the operator's hand.

Many machines show 75 per cent greater average daily productivity.

DE VLIEG MACHINE COMPANY
450 FAIR AVE. FERNDALE (DETROIT) MICHIGAN

Write for Circular

DEVLIEG MACHINE TOOLS

Making the molds, preparing the metal, casting it, heat-treating the finished castings; these are things requiring great skill. These men have it! As the demand for planes continues to soar, there is greater need for magnesium castings. These men make them!

American Magnesium foundrymen, like all other workers here, are backed by the know-how that comes from more than twenty years of working with magnesium. Constant research has kept Mazlo Magnesium products at the head of the parade throughout the years. Today, that knowledge is producing superior parts for war materiel.

American Magnesium workers realize that every piece they produce is going to Uncle Sam's fighting men. As they boost their production, they are helping their sons, their brothers, their former fellow-workers. No wonder they have a will to win.

All of this fabricating skill, this will to do an expert job, will be at your command when the demands of war are taken care of. Mazlo Magnesium products . . . castings, forgings, extruded shapes and sheet . . . will help you employ this lightest of the lightweight metals to best advantage. Sales Agent: Aluminum Company of America, 1709 Gulf Building, Pittsburgh, Pennsylvania.

MAGNESIUM MAZLO PRODUCTS

REG. U.S. PAT. OFF.

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

Speeding Production of ANTI-AIRCRAFT GUNS *with* CINCINNATI HYPRO BORING MILLS

★ Here a Cincinnati Vertical Boring Mill is machining steel loader rods used in an anti-aircraft gun.

Originally the loader rods, which are segments of a large circle, were manufactured from individual forgings.

Distortion during machining was met with. To avoid this the manufacturer rolled a bar of steel into a ring, butt-welded the ends, and then turned the ring on a Cincinnati Hypro Boring Mill.

The turning operations included:

1. Rough and finish-turn internal diameter and bottom of the ring surface.
2. Ring is laid with finished surface down on table fixture. Clamps are positioned against the finish-turned inside diameter, being careful to indicate the part to 0.001 inches. Outside diameter is then rough and finish-turned.
3. Additional clamps are placed on the finished outside diameter while semi-finishing the sides and floor of the channel section. Following this, sides are finished down to the floor.
4. Clamps are removed and over-all height of the piece and channel floor is finish-faced.

This method proved highly satisfactory—sped production and released critical machinery for other work.

For hypro-duction—unfailing accuracy—versatility and ease of operation—specify the Cincinnati Hypro Vertical Boring Mill.

Write for complete information in illustrated Bulletin 130 AM.

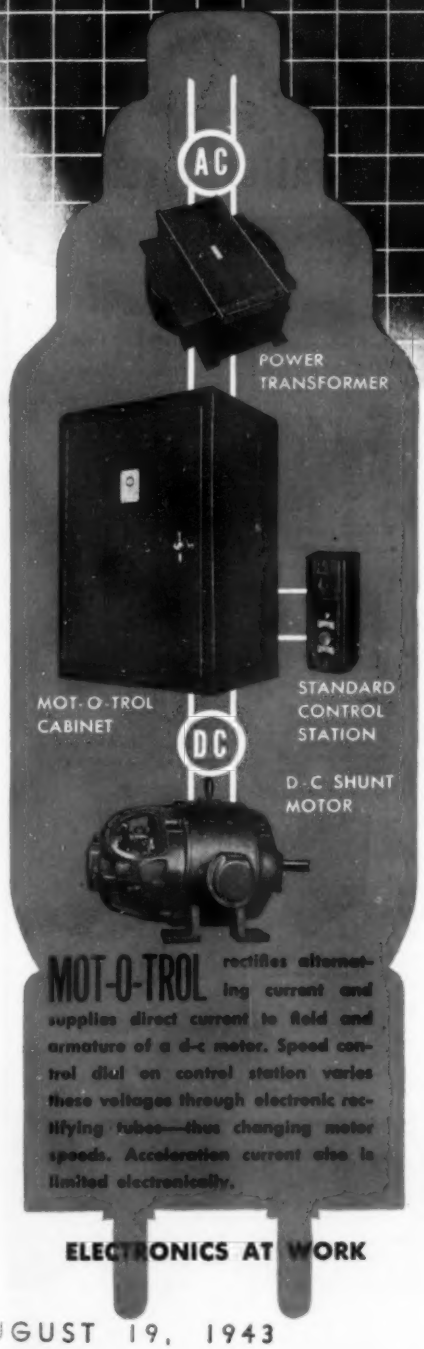
THE CINCINNATI PLANER COMPANY

Planers...Vertical Boring Mills...Planer Type Millers

CINCINNATI . OHIO . U.S.A.

Electronic VARIABLE SPEED MOTOR DRIVE

...Westinghouse MOT-O-TROL


AC
POWER TRANSFORMER
MOT-O-TROL CABINET
STANDARD CONTROL STATION
DC
D-C SHUNT MOTOR
MOT-O-TROL rectifies alternating current and supplies direct current to field and armature of a d-c motor. Speed control dial on control station varies these voltages through electronic rectifying tubes—thus changing motor speeds. Acceleration current also is limited electronically.
ELECTRONICS AT WORK

- **Wide, Stepless Speed Range**
- **Automatic Speed Regulation**
- **Smooth, Fast Acceleration**
- **Automatic Current Limitation**

Once speed is set, MOT-O-TROL, the new Westinghouse motor control, maintains pre-set motor speeds under all loads and makes possible new, wide-range stepless selection of motor speeds.

With the precision of electronics and finger-tip control, MOT-O-TROL operates d-c motors from an alternating-current source. It is a marked improvement over conventional d-c motor drives, even where d-c is available.

All drive speeds are controlled by one dial. MOT-O-TROL equipped machines have only one rotating element . . . the driving motor. Vibration problems are minimized, acceleration is smooth, starting shock and current peaks are reduced. Other available MOT-O-TROL functions include: dynamic braking, reversing, inching forward, inching reverse.

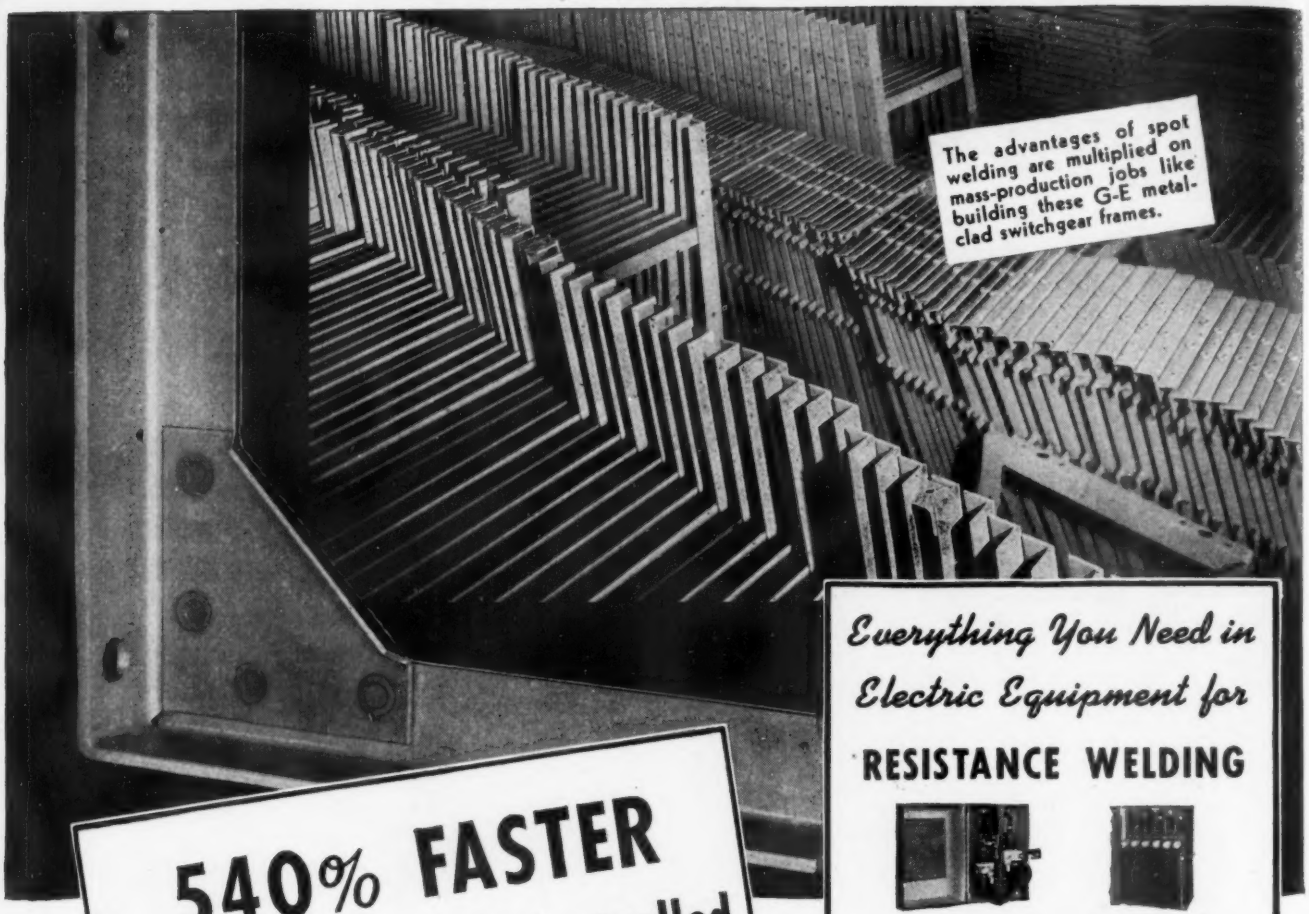
Send for booklet B-3256 or call your Westinghouse Office for complete information. Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

J-21284

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

Electronic **MOTOR CONTROL**



The advantages of spot welding are multiplied on mass-production jobs like building these G-E metal-clad switchgear frames.

540% FASTER with Electronically Controlled SPOT WELDING

SPOT-WELDING the thousands of corners for G-E switchgear enclosures speeded production 540 per cent over riveting; 375 per cent over bolting. Spot welding eliminated punching holes, inserting rivets or bolts, and the riveting or bolting operations—saving time, material, and man power.

Electronically controlled resistance welding is speeding the construction of light-metal and stainless-steel aircraft. It's replacing soldering, too, saving tin and time. Joining like or unlike metals and alloys. Giving dependable, *consistent* results. Making gastight seams. Helping speed the training of new operators. Resistance welding is ideal for high-production operations on heavy or light work, portable or fixed.

Whatever your application, be sure to specify G-E electronic control and other electric accessories. For further information, contact any G-E office, or your resistance-welder manufacturer or agent. Or write General Electric, Schenectady, N. Y.

Everything You Need in Electric Equipment for RESISTANCE WELDING

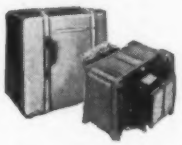
Electronic controls for spot and seam welders

Electronic weld and sequence timers

Weld-recorders—to record electrical input of EVERY weld

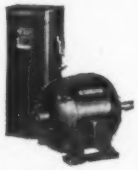
Electron tubes for all purposes

Cables and instruments



Air circuit breakers and welding transformers

Capacitors for power-factor improvement



Motors and control

Speed Production Electronically

GENERAL ELECTRIC

Battery of Bullard Vertical Turret Lathes working 24 hours a day in the plant of a midwestern maker of valves.

V.T.L. *Veterans—with a Future*

Of the thousands of Bullard Vertical Turret Lathes now working at top speed on war production . . . many of them have already put in many years of service in the normal work of a world at peace.

And all of them will be ready to continue their cost and time-saving that will be so essential in the world at peace. For the same qualities that make the Vertical Turret Lathes indispensable now are always important: Speed. Accuracy. Adaptability. Lower machining costs.

The sturdy, rigid construction of these machines makes them long-lived. Their versatility keeps these long lives useful. They'll help you win the war now . . . and help you beat competition when the war is won.

BULLARD

THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

Can you find the Three Saboteurs?

THEY'RE not enemy aliens, though they might as well be, because they're actually sabotaging night shift production in war plants all over the country!

?

Saboteur No. 1 is dirt on lighting equipment, walls and ceilings. A regular cleaning program can save as much as 50% on light.

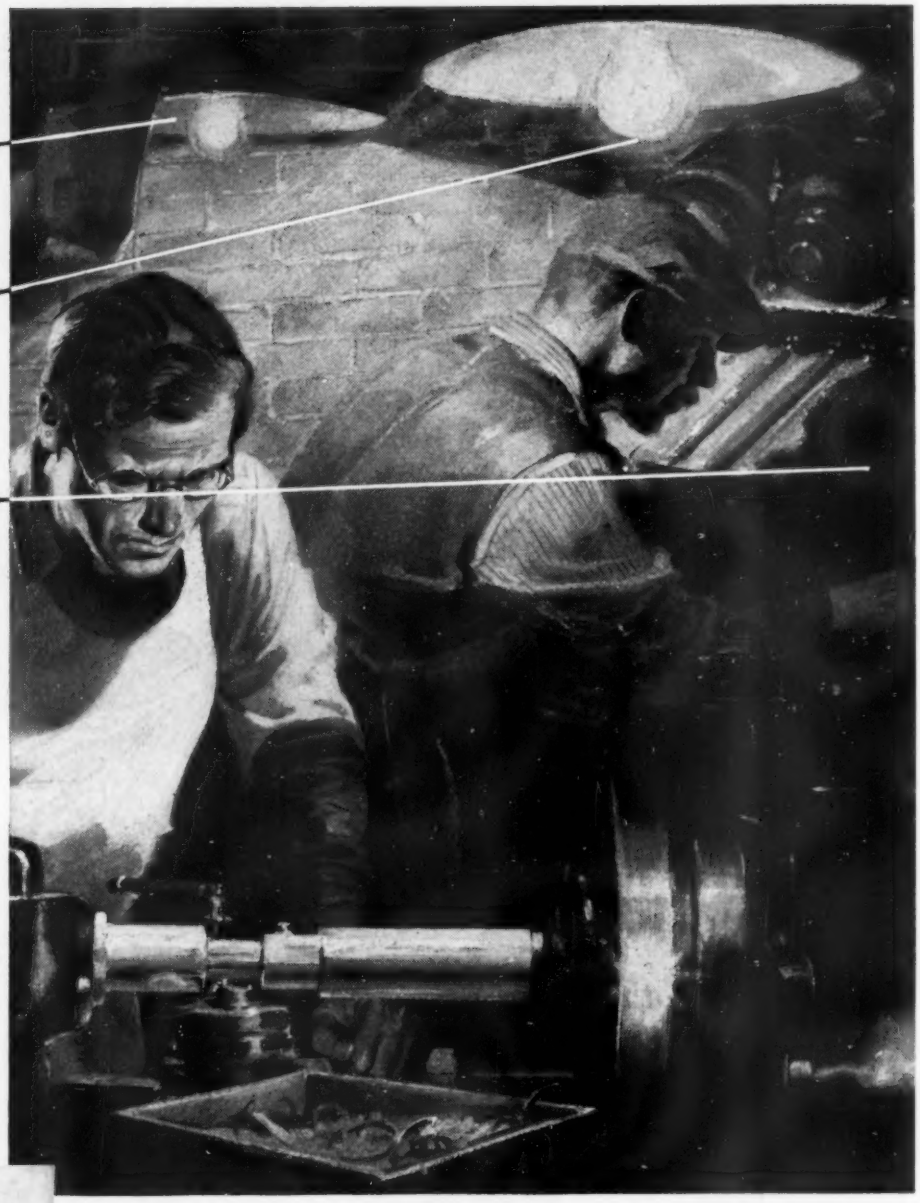
?

See the glare from those bulbs and from the machine? Glare is Saboteur No. 2. It tires men out —increases chance of spoilage.

?

See the man on the right, working in his own shadow? Shadows are Saboteur No. 3. They put unnecessary strain on eyes and nerves.

You'll find these saboteurs even in the newest plane factories. But the plants they love best are the ones that never worked a night shift before—where lighting was originally installed *only as an aid to daylight.*



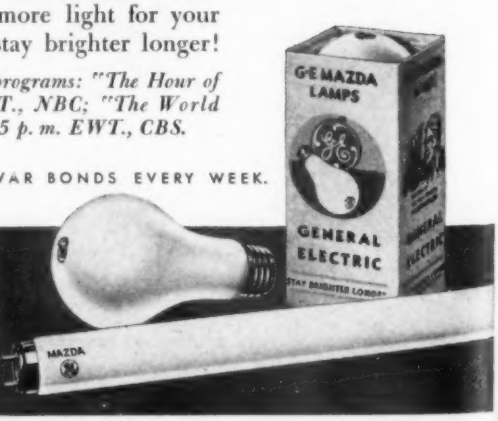
To Production Men

Call General Electric and ask for a wartime lighting counsellor. Without obligation, he will show you how lighting can be revamped to improve seeing—by cleaning, moving a fixture here and there, painting, or removing glare. Phone your nearest G-E lamp office, G-E lamp supplier, or electric service company.

EYES AT WORK NEED GOOD LIGHT... and G-E research is constantly at work to make G-E Mazda lamps give you more and more light for your money. They are made to stay brighter longer!

Hear the General Electric radio programs: "The Hour of Charm", Sunday, 10 p. m. EWT., NBC; "The World Today"—news, weekdays, 6:45 p. m. EWT., CBS.

GENERAL ELECTRIC EMPLOYEES ARE NOW BUYING $1,000,000 WORTH OF WAR BONDS EVERY WEEK.



G-E MAZDA LAMPS

GENERAL ELECTRIC

METRO

CARBIDE TIPPED *Tools*

STANDARD OR SPECIAL

AVAILABLE RIGHT OR LEFT HAND

★ Standard or Special for machining of steels, cast iron, brass, bronze, aluminum, and non-metallics.

Special carbide-tipped tools to your prints. Our engineers can help you solve tough machining problems.

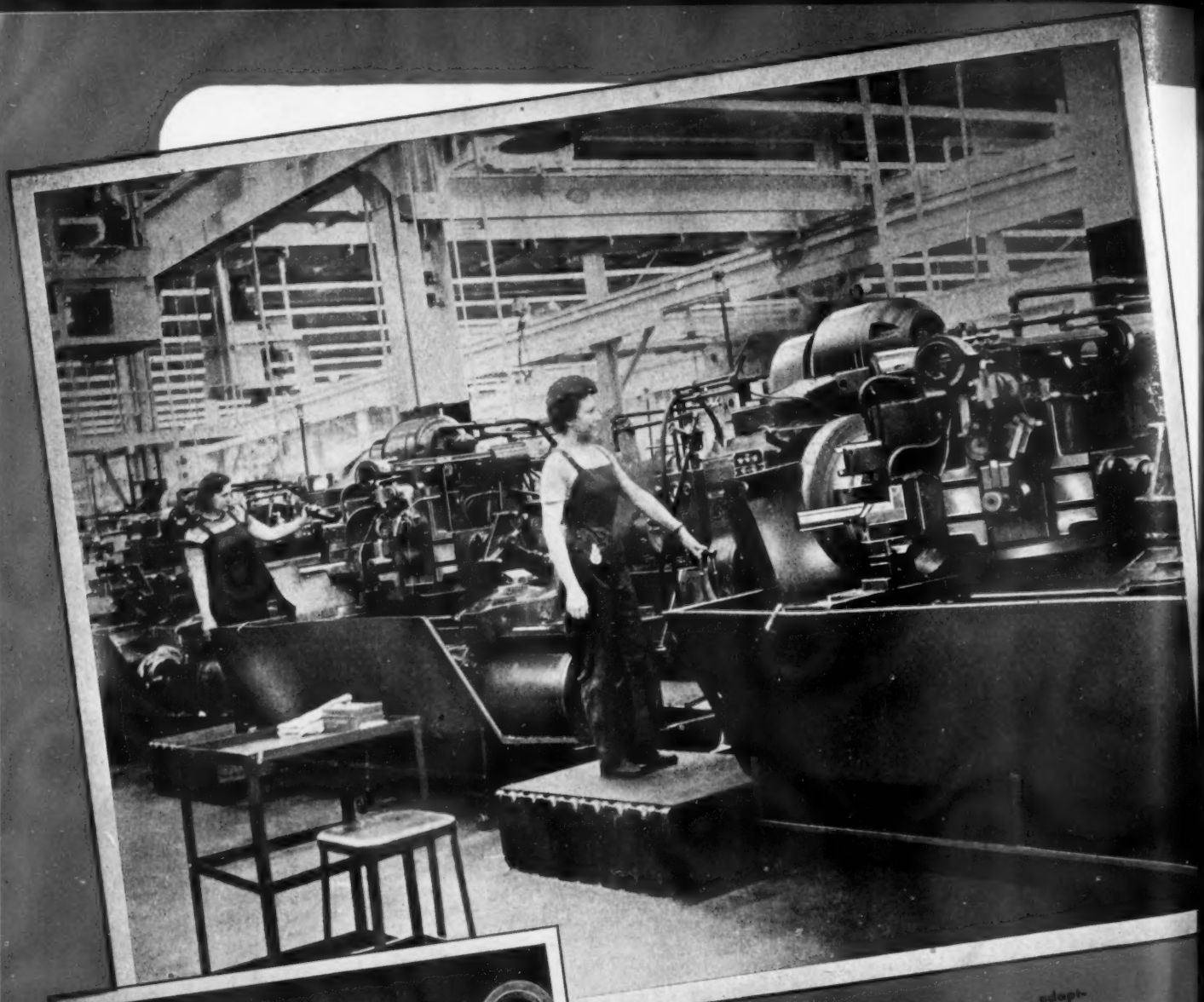
Get your copy of METRO Catalog No. 101 . . . contains complete data on all METRO Precision Tools and Gages.

METRO

TOOL AND GAGE CO.

4240 PETERSON AVE.

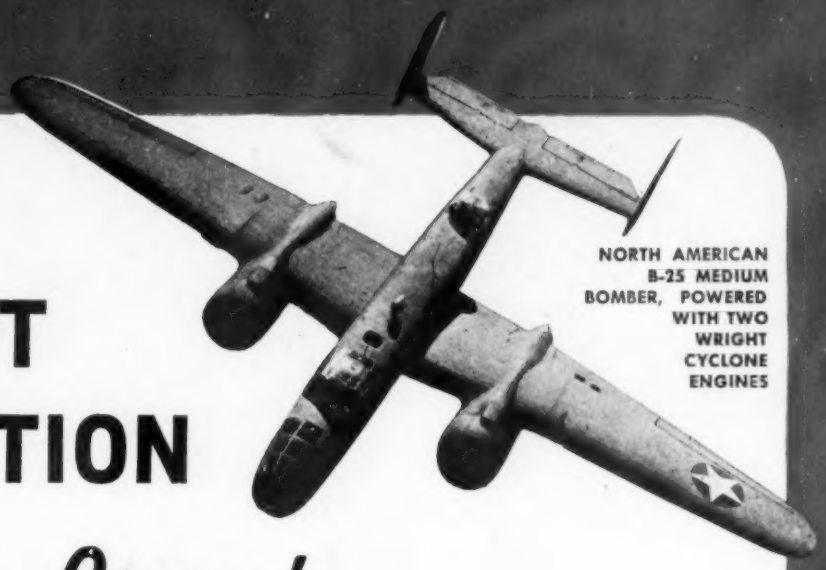
CHICAGO, 30, ILL.



Convenience and ease of operation are evident . . . adaptability to women workers graphically indicated . . . in the close-up (left) and general view (above) of a battery of P & J 8D Automatics machining 205 lb. forgings in the Aeronautical Division of the Otis Elevator Company.

P&J POTTER and JOHNSTON

Helping Keep America's AIRCRAFT PRODUCTION *on the Beam!*



NORTH AMERICAN B-25 MEDIUM BOMBER, POWERED WITH TWO WRIGHT CYCLONE ENGINES

The wide acceptance of P&J Automatics for Aircraft Production is not by mere chance. The very qualities vital to the success of our huge aircraft production program — maximum production coupled with the greatest possible accuracy — are typified in the finely balanced combination of speed and precision which is inherent in every type of Automatic in the P&J line. The power and rigidity of these machines assure maximum cutting speeds and feeds, fine finishes, and the requisite high accuracy . . . all attuned to current heavy production demands.

Large forgings of tough materials are handled easily for such operations as turning, facing, boring, drilling, reaming, recessing, beveling, undercutting. The photographs show a typical job of this kind being handled with ease and speed on a battery of P&J Automatics in the Aeronautical Division of the Otis Elevator Company. Weighing approximately 205 lb. apiece, the forgings being machined are destined for use in connection with crankcases for Wright Cyclone Radial Engines . . . another of numerous instances indicating how P&J Automatics and P&J Tooling are contributing real punch to the war effort with savings in material, man-hours and machine-hours in a day when such economies count mightily.

POTTER & JOHNSTON MACHINE COMPANY
PAWTUCKET, RHODE ISLAND

AUTOMATICS

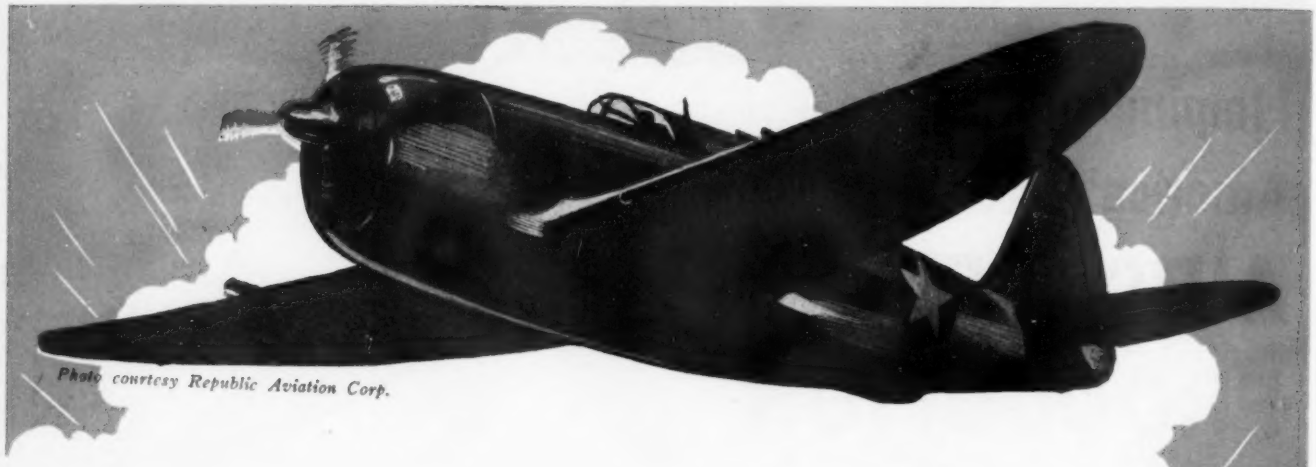


Photo courtesy Republic Aviation Corp.

FROM TIP TO TAIL

Brightboy

SIMPLIFIES | **SPEEDS UP** | **IMPROVES**

DE-BURRING • FINISHING • POLISHING

"THE SOFT RUBBER BINDER CUSHIONS THE ABRASIVE"

ALMOST UNBELIEVABLE RESULTS in time saving and improved de-burring, finishing and polishing operations constitute war production achievements of Weldon Roberts BRIGHTBOY Products.

BRIGHTBOY is widely used in plane and engine construction, shipbuilding, munitions making, parts manufacture. In use the abrasive *recedes* into the resilient rubber binder, working with minimum dimensional loss to the metal — giving a finish which frequently serves as a final polish — eliminating the operations between a grind and a buff.

Various degrees of finish are achieved by regulation of machine speed. Brightboy does not load, gum nor fill. No time-taking preparations are required. Any worker can use it. No special training necessary.

Brightboy Methods and Applications Data will give you valuable suggestions. Brightboy service men will gladly call and help you—at no obligation. Write us if your dealer cannot supply you with literature and prices.

BRIGHTBOY INDUSTRIAL DIVISION
Weldon Roberts Rubber Co.
Newark New Jersey

WHEELS
BLOCKS
STICKS
RODS

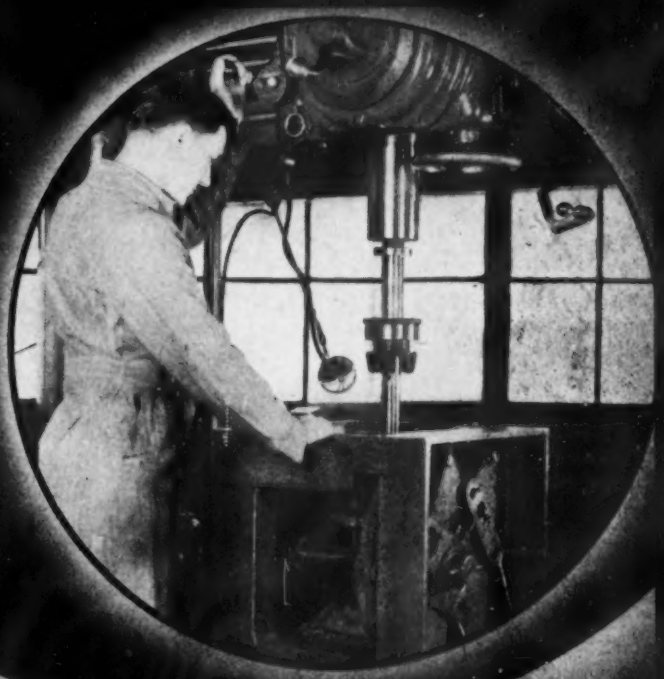
For manual and machine operations

WELDON ROBERTS

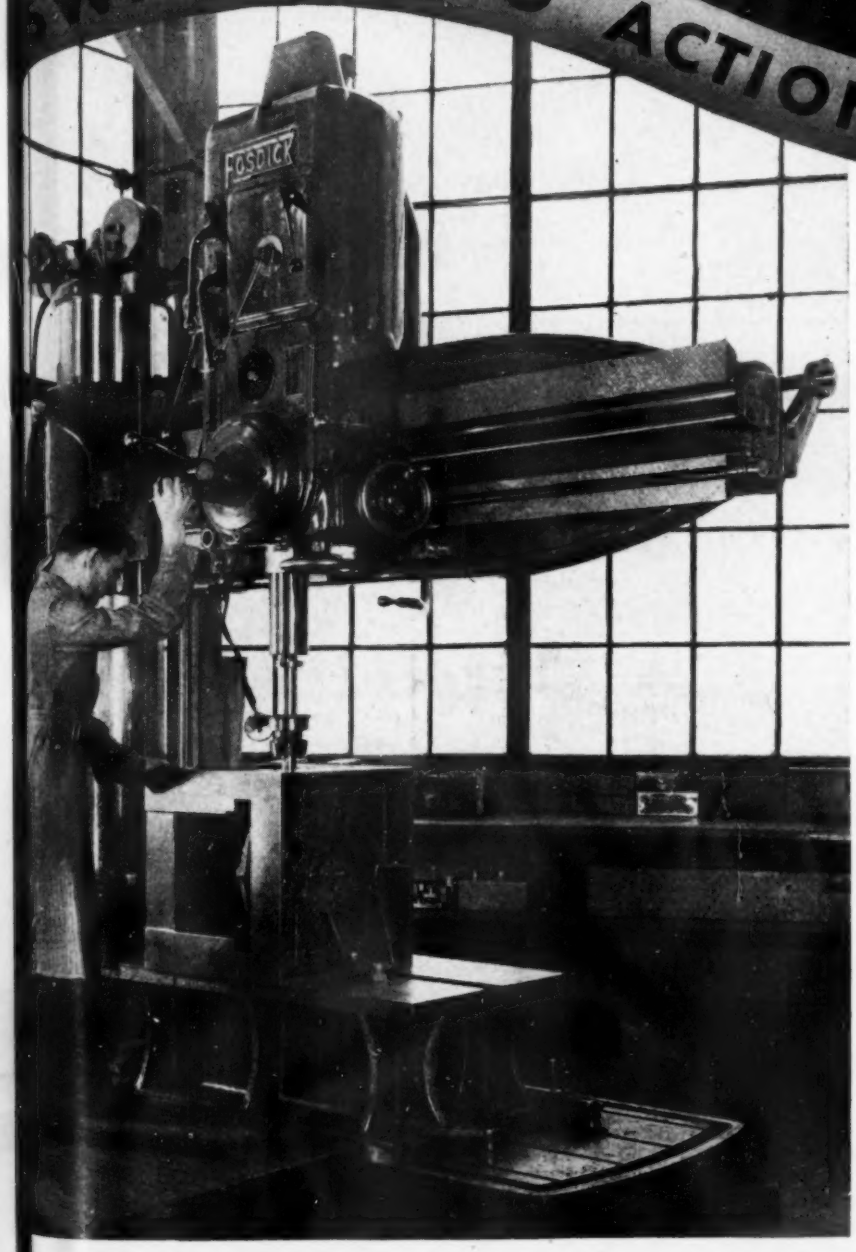
Brightboy

REG. U.S. PAT. OFF.

FOSDICK RADIAL



SWINGS INTO ACTION AT . . .



A PROMINENT MACHINE TOOL PLANT

● The large diameter column — the sturdy rigid arm — the centralization of all feeds and speeds in the head make for versatility — accuracy — and ease of operation of Fosdick Hydraulic Radials.

Here a Fosdick Radial is drilling — reaming and tapping various diameter holes in a piece mounted in a box jig. The jig facilitates handling and speeds up production in that it locates holes quickly on which operations are to be performed and permits turning the work for holes on different sides of the piece.

Fosdick Radials now in service in War Plants have also proved accurate, versatile machines turning out a wide range of work at low cost.

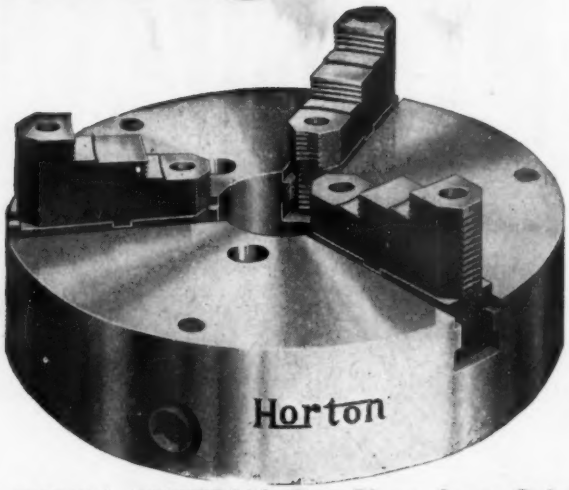
PUT YOUR NEXT RADIAL JOB ON A FOSDICK

Fosdick Radial Bulletin RA provides complete details on construction and operation. Write for one.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI · · · OHIO

Horton chucks

INDEPENDENT Solid Reversible Jaws Only

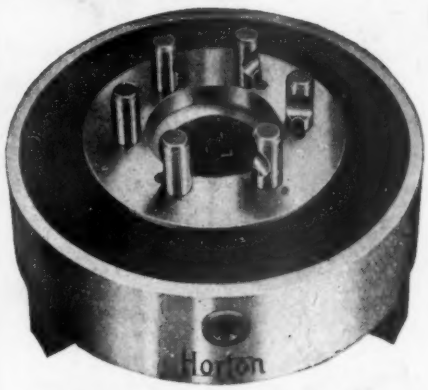


SCROLL UNIVERSAL Two-Piece Jaws Only

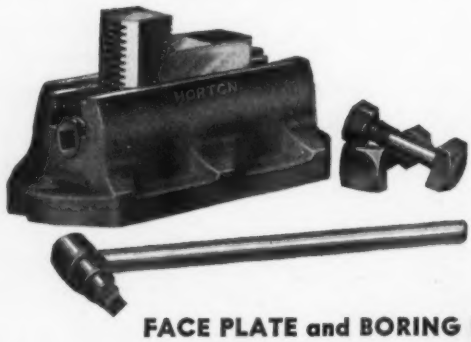
For Use With Intermediate Plates On Threaded Spindles

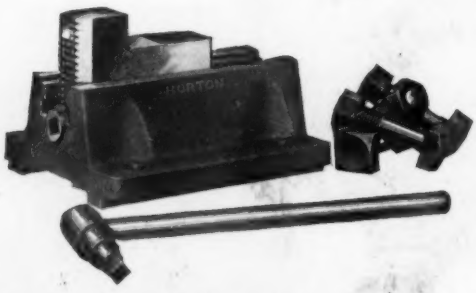
For Key Drive Tapered Nose Spindles

War Production Limited To These Essential Chucks



For Flanged Tapered Nose Spindles
Illustration shows Chuck for Type D (Cam Lock) Spindle

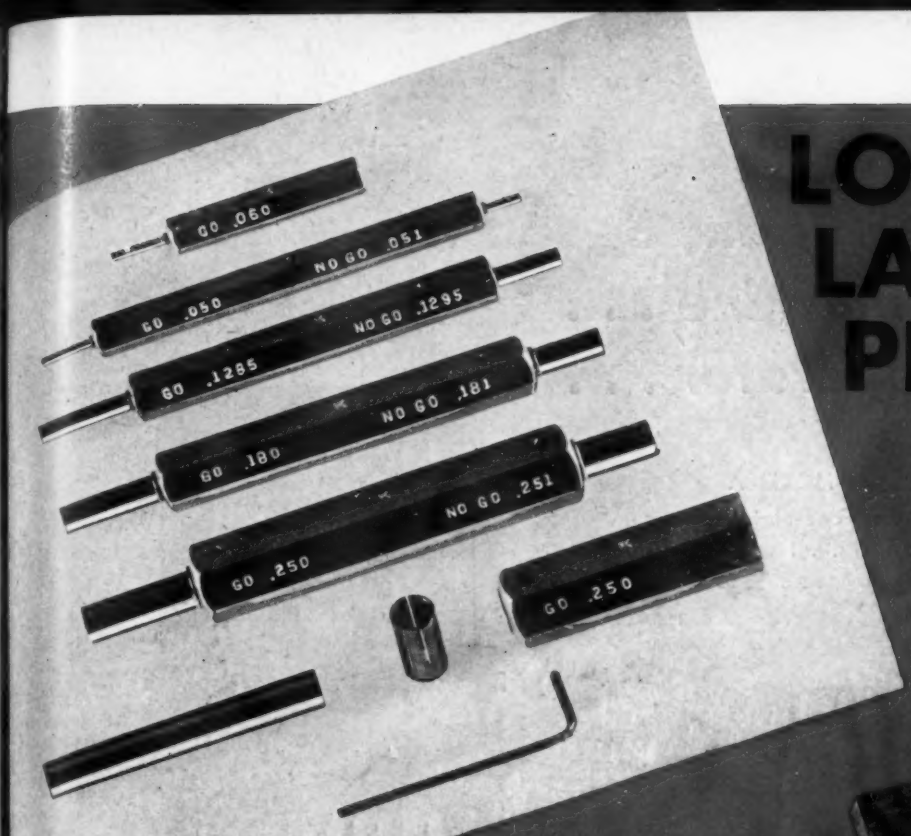




FACE PLATE and BORING MILL JAWS—Steel Body Only

HORTON
MORROW

SINCE 1851 ....THE E. HORTON & SON CO.
WINDSOR LOCKS, CONNECTICUT, U. S. A.



WIRE TYPE PLUG GAGE SET No. 60. These gages provide an accurate means of measuring small holes and also standards for checking twist drills in sizes from 1 to 60. (.228" to .040" dia.) PRICE $325.00.

LONGER LASTING PRECISION

On Small Hole Measurements

Van Keuren WIRE TYPE PLUG GAGES

Taper insert plug gages in small sizes cost a lot per unit of usable surface. Van Keuren Wire Type Plug Gages give longer lasting precision because the entire 2" length of the gaging unit can be used. Split bushings and headless set screws clamp the wire units securely in the handle. When a unit becomes worn it may be ground off and a new section moved out.

All Van Keuren Wire Type Plug Gages are made to a standard tolerance of +.00005" —.00000" on Go units; ±.000025" on No Go units. Closer or wider tolerances can be supplied if desired.

Van Keuren Wire Type Plug Gages are but one of the many types of measuring equipment in which we specialize. Write for Catalog 31 describing our complete line. More than a catalog! . . . It is a valuable handbook of precision measuring methods.

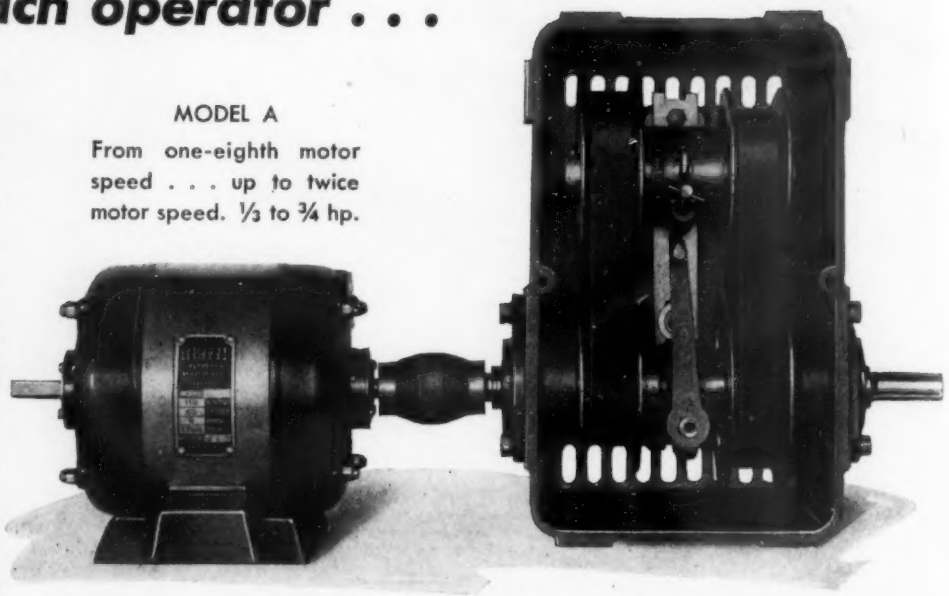
THE Van Keuren CO., 24th YEAR 176 WALTHAM ST., WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Sine Triangles

For the Most Efficient Speed . . .
. . . for each machine . . .
. . . for each operator . . .

MODEL A

From one-eighth motor speed . . . up to twice motor speed. ⅓ to ¾ hp.



Check

The WORTHINGTON ALLSPEED DRIVE FEATURES

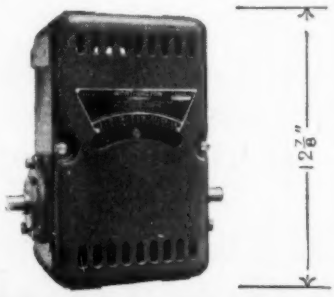
- **Single-unit construction . . . compact and strong**
- **16 to 1 speed ratio . . . highest speed ratio in its price range**
- **Positive automatic belt tensioning . . . without springs**
- **Absolute assurance of smooth efficient operation**
- **Can be installed in any position . . . on any machine, new or old**
- **Can be used with any standard motor, 1725 to 1800 r. p. m.**
- **Operates in either direction . . . direct-connected to motor or through V-belt or flat-belt drive**

The WORTHINGTON ALLSPEED DRIVE

Reports from many plant engineers and time-study men show that their production has been stepped up 25% to 200% with this equipment. Another war-time value is the fact that it simplifies the training of machine operators . . . by permitting initial operation at low speeds, increasing the speed gradually as skill is acquired.

The advantages of such FINGER-TIP SPEED CONTROL are many and far-reaching. There are probably applications in *your* plant in which the Worthington Allspeed Drive could be used to advantage.

Write for literature . . . and ask the nearest Worthington office or dealer for a demonstration



MV3-6

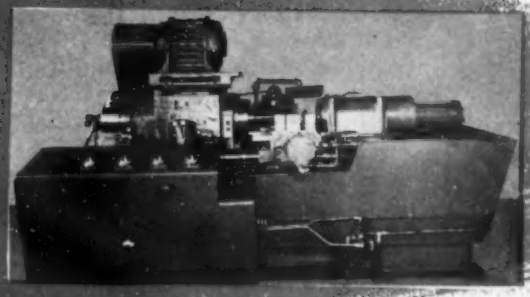
WORTHINGTON

WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

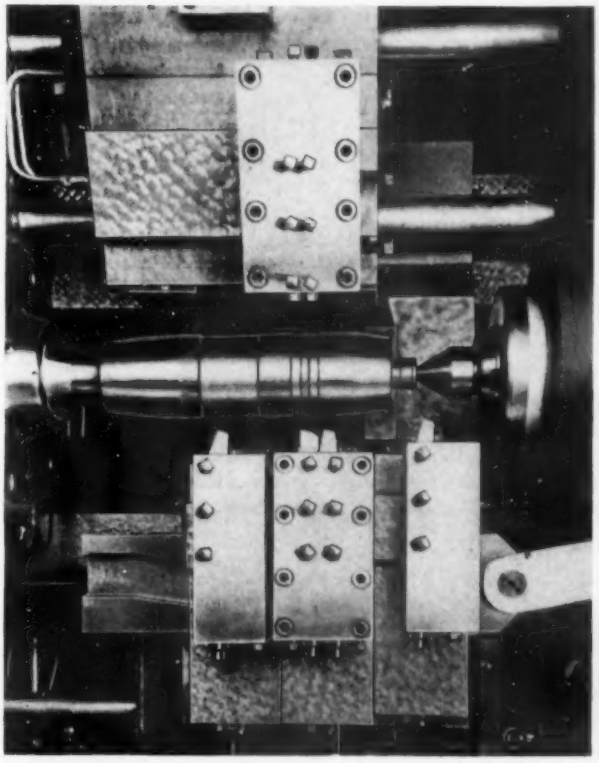
Make Maximum use of Available Manpower

by utilizing the mass production capacity of the

SPARKS



SEMI-AUTOMATIC HYDRA-FEED LATHE



● SPARKS LATHES are demonstrating their remarkably high productive capacity in every day performance by turning out more pieces in less time. They are making mass production records in many war-busy plants which, judged by previous standards, would not have been believed possible.

For example, finish-turning 85 m/m shell. Although a shell is shown as an illustration, production engineers can readily see the possibilities of using the SPARKS for other mass production work, because of the adaptability of the machine to a wide range of tooling. In the case illustrated, the cutting time per piece is 38 seconds. This outstanding speed is achieved through a combination of multiple tooling with full hydraulic control and rapid traverse of tools during non-cutting portions of the cycle, basic features of the SPARKS applicable to all turning operations.

Let us show how you, too, can step up production with the SPARKS. Send blue prints of parts on which you need HIGHER PRODUCTION and our engineers will gladly give you a time estimate for handling the job on the SPARKS.

SPARKS HYDRA-FEED LATHE

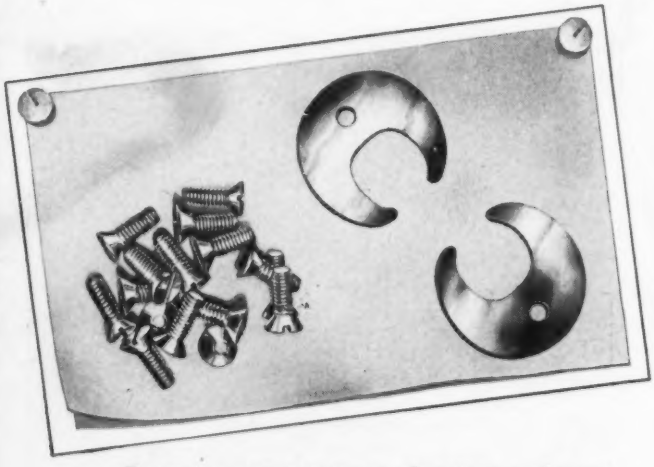
SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

You can use this help to get MORE Advantages — Improved Products from Stainless Steel . . .

TO help you do a trouble-shooting job on new and difficult Stainless design or fabricating problems, we have prepared this easy-to-use information. Use it to take advantage of the physical properties and fabricating qualities provided by these types of Stainless Steel.

These straight chromium Stainless Steels are hardenable by heat treatment, and provide the basic corrosion resistance needed for many applications. Future messages will give you helpful information on other types of Stainless Steel to meet specific conditions in service. Meanwhile, if you could use more details about these and other types of Stainless, write for a copy of the data book described on the opposite page.

And when you have a tough design or fabricating problem, take advantage of Carpenter's diversified experience. Your nearby Carpenter representative can provide on-the-spot assistance, or keep you in close touch with our Metallurgical Department. Get in touch with him whenever the need arises.



Fastenings, certain types of springs and many heat treated parts can be produced economically from Carpenter Stainless No. 1.

For Low Cost Products With Stainless Properties . . .

Carpenter Stainless No. 1 — Type 410

Think of the .30% carbon SAE alloy steels with their strength and toughness—then add *corrosion resistance*—and you have described Carpenter Stainless No. 1. The least expensive of all Stainless Steels, it is often used for products like fastenings, springs, valve seats, pump shafts and many heat treated parts. Whether heat treated or not, this Stainless resists corrosion from atmosphere, fresh water, steam, crude oil, carbonic acid, alcohol, etc.

Fabricating Qualities: This grade machines about like SAE 3140—is readily forged, cold worked, welded, brazed, soldered, heat treated. It is available in forging billets, bars, wire and strip.

Physical Properties of Carpenter Stainless No. 1

Type 410 — (Carbon .10% — Chromium 13.00%)

Tensile strength—80,000 to 190,000 lbs. per sq. in.
Specific gravity—7.78 (1% lighter than mild steel).
Melting point—About 2525°F.
Specific heat—.061 Cal. per degree F.
Thermal conductivity — .096 C.G.S. units at room temperature.
Coefficient thermal expansion—.0000057 average between 60°F. and 1500°F.
Specific electrical resistance—350 ohms per cir. mil foot at 68°F. Temperature coefficient —.00077 per deg. F. between 68°F. and 1100°F.
Magnetic properties (in annealed condition)—

Magnetizing force	200
Maximum Induction	17,360
Residual Induction	12,500
Coercive force	8

Elastic modulus—29,000,000.

note

The physical properties of all grades of Stainless Steel depend upon form, heat treatment or cold working. Wider ranges of properties are available in certain forms. Take up your special problems with our Metallurgical Department.

Carpenter STAINLESS STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

Here's Your Carpenter *Turbine Quality* Stainless . . .

This special Turbine Quality grade of Carpenter Stainless No. 1 is specially inspected to insure high quality and uniformity. As most generally used, it is heat treated to produce the following typical physical properties:

Elastic limit, lbs. per sq. in.	*80,000*
Tensile strength, lbs. per sq. in.	*107,000*
Elongation in 2", %	*22*
Reduction of area, %	*66*
Brinell hardness number	*223*
Izod impact, ft. lbs.	*95*

For *Greater Hardness* In Stainless Parts . . .

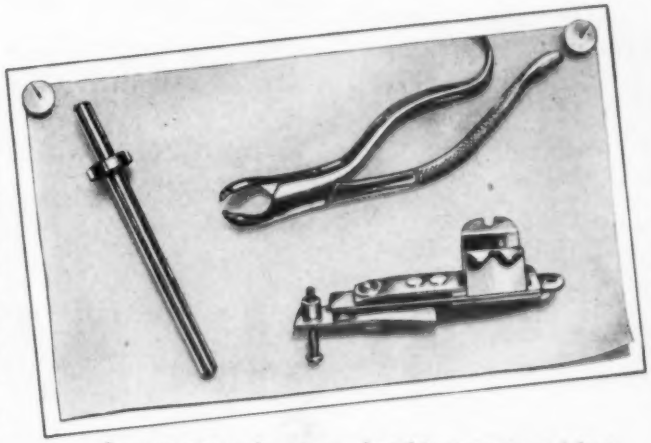
Carpenter Stainless No. N-1 (Type 414) provides greater hardness for products like knife blades, tempered rules, scraper knives, mild springs, etc.—and offers somewhat better corrosion resistance than Carpenter Stainless No. 1. It can be furnished heat treated to special temper with C-43 to C-48 Rockwell hardness, in which condition it can be blanked, moderately formed, polished or buffed—and used without further heat treatment. Billets, bars and hot-rolled coils are also available for further cold finishing and tempering. For tensile properties, etc., see "Working Data for Carpenter Stainless Steels", described below.

The "Cutlery Type" Stainless for *Extra Hardness and Strength* . . .

Carpenter Stainless No. 2—Type 420

This grade gives you more hardness and strength than Stainless Types 410 and 414. It is *never* used "as annealed" because it requires hardening to bring out its corrosion resisting properties, which are similar to those of Carpenter Stainless No. 1. Used for cutlery, surgical and dental instruments, gauges, etc.—it also has some uses at elevated temperatures for springs, valve parts, etc. It should *not* be used for heavily stressed parts operating at sub-zero temperatures.

Fabricating Qualities: This Stainless machines about like SAE 3250, can be forged, cold worked, welded, soldered, etc. *Always* used in the hardened condition, it must be free of surface scale to provide full corrosion resistance.



Long-wearing valve stems, dental instruments and heat control assembly units are a few of the many products made from Carpenter Stainless No. 2. Positive corrosion resistance supplements its strength and hardness properties.

Physical Properties of Carpenter Stainless No. 2

Type 420—(Carbon .30%—Chromium 13.00%)

Tensile strength—90,000 to 260,000 lbs. per sq. in.

Specific gravity—7.75

Coefficient thermal expansion (hardened) .0000059 average 60°F. to 1500°F.

Magnetic properties—Residual magnetism: 6,000 Gausses. Coercive force: 55 Oersteds.

Tensile properties—(Average properties—short time test—for 1" round, oil quenched from 1825°F., drawn at 400°F., pulled at room temperature.)

Elastic limit, lbs. per sq. in.	*225,000*
Tensile strength, lbs. per sq. in.	*260,000*
Elongation in 2", %	*11*
Reduction of area, %	*32*
Scleroscope hardness	*72*
Brinell hardness numeral	*512*
Rockwell hardness	*C-52*

Where *Maximum Hardness* Is Needed . . .

Carpenter Stainless No. 2-B (Type 440) is similar to Carpenter Stainless No. 2, but becomes considerably harder when heat treated. More difficult to fabricate, it is used for needle valves, ball check valves, ball bearings, etc. — where Rockwell hardness C-58/60 is essential. This Stainless resists the same corrosive elements as Carpenter Stainless No. 2, but with perhaps somewhat less "factor of safety".

Where fabricating conditions demand free-machining properties with the general physicals of Type 440, use Carpenter Stainless No. 2-B-FM (Type 440F).

And Here's Still More Help!

This 98-page data book is packed full of information to help you speed fabricating and get the most from the physical properties of Stainless Steel. It is offered free to Stainless users in the U. S. A., so for your copy, drop us a note on your company letterhead.

The Carpenter Steel Company • 109 Bern Street, Reading, Pa.

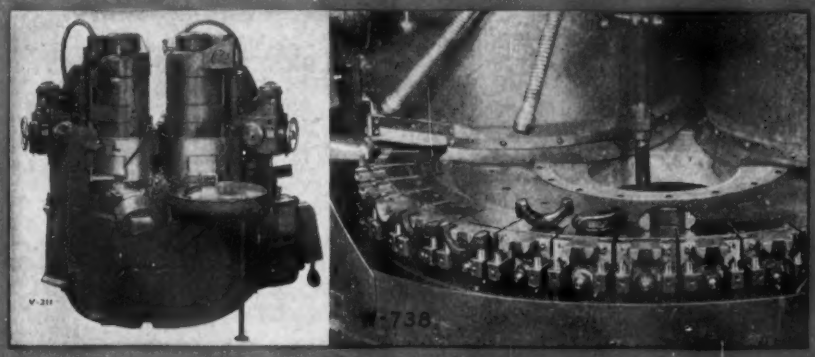
"PUT IT ON THE BLANCHARD"

ONE operator on this No. 16-A2 Blanchard Automatic Surface Grinder produces 1970 steel connecting rod caps per hour, ground on the joint face. He can load and unload the 34 station automatic clamping fixture as the stations pass in front of him. The wheel control calipers take care of the sizing automatically.

.040″ to .070″ of stock is removed from these connecting rod caps to limits of ±.001″. A minimum of 90% flat bearing surface is produced.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.



Grinding Connecting Rod Caps on No. 16-A2 Blanchard Automatic Surface Grinder.

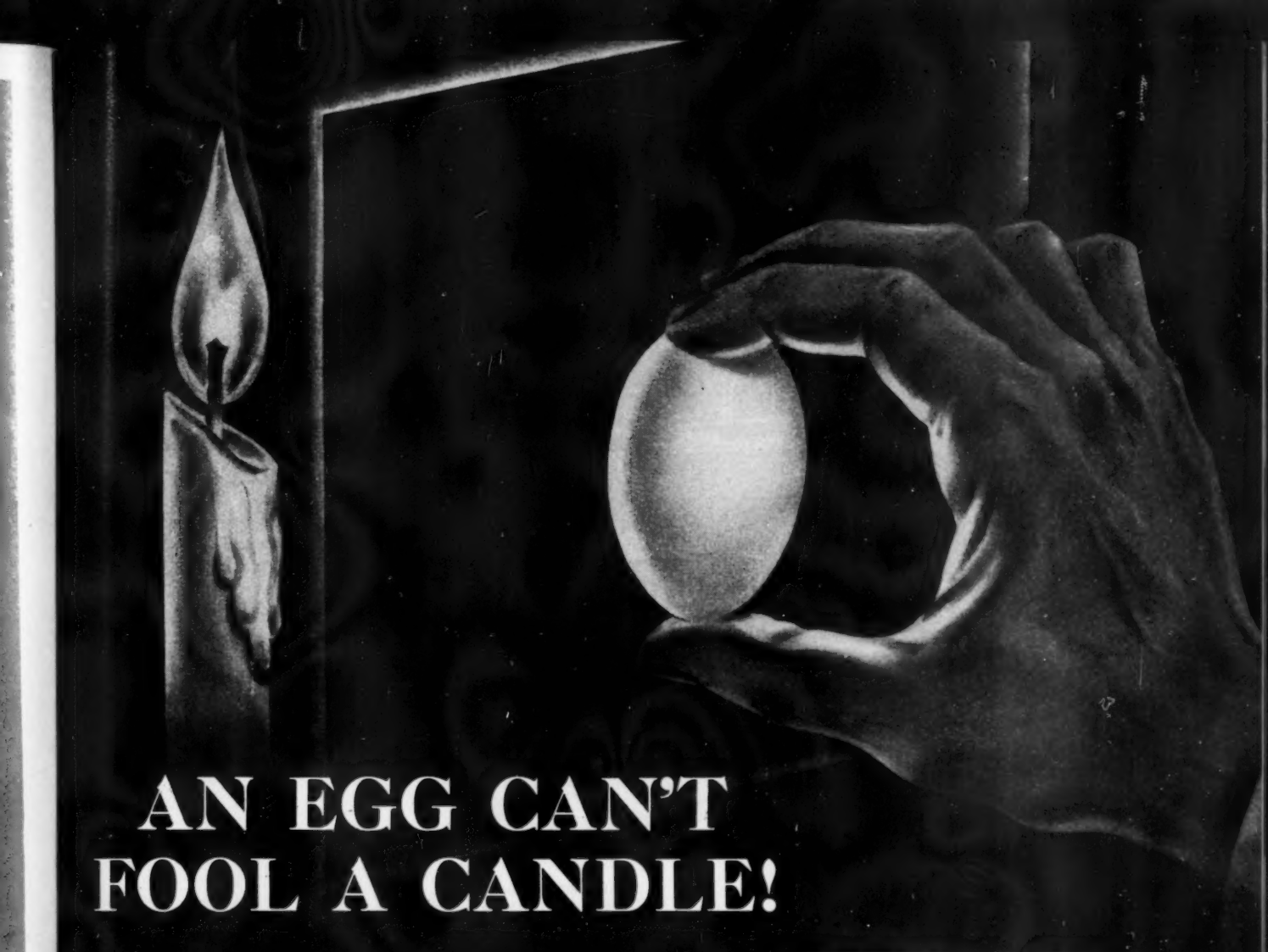
BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

★ Production
Adaptability
Fixture Saving
Operation Saving
Material Saving
Fine Finish
★ Flatness
Close Limits

★ . . . . . *Especially valuable on jobs like the one illustrated.*

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



AN EGG CAN'T FOOL A CANDLE!

IN a few seconds with the candling process, you can pry out the innermost secrets of an egg!

Almost as quickly, you can "see through" the facts of balance in any rotating part.

The amazing speed and accuracy of Gisholt Dynetric Balancing is achieved with electron tubes through which unbalance vibrations as small as .000025" are clearly recorded on a sensitive meter. Such extreme accuracy is not required in commercial balancing, yet it indicates why Gisholt Dynetrics are pre-eminent in the field for balancing any part from 1 ounce to 50 tons.

GISHOLT DYNETRIC BALANCING MACHINES *are protecting many vital war products against vibration, bearing overloads, and excessive wear. Literature on Dynetric Balancing is yours for the asking.*

GISHOLT MACHINE COMPANY
1201 E. Washington Avenue • Madison, Wisconsin

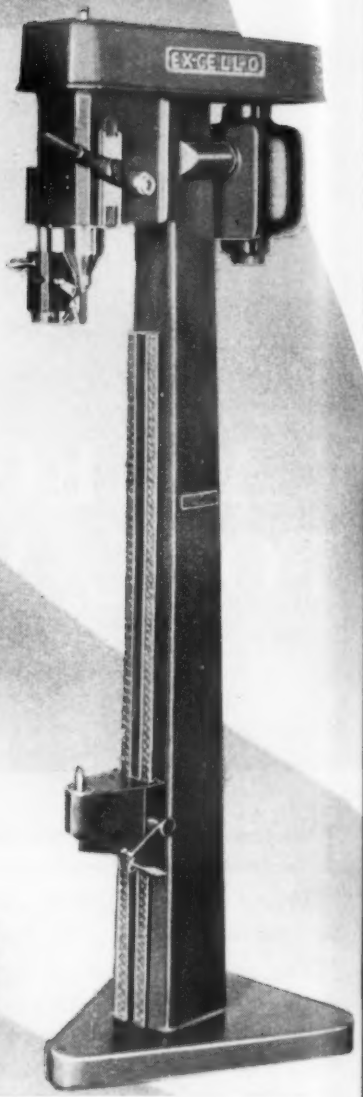
LOOK AHEAD
KEEP AHEAD
With Gisholt Improvements

The Army-Navy "E" and the Treasury Flag fly side by side at Gisholt.

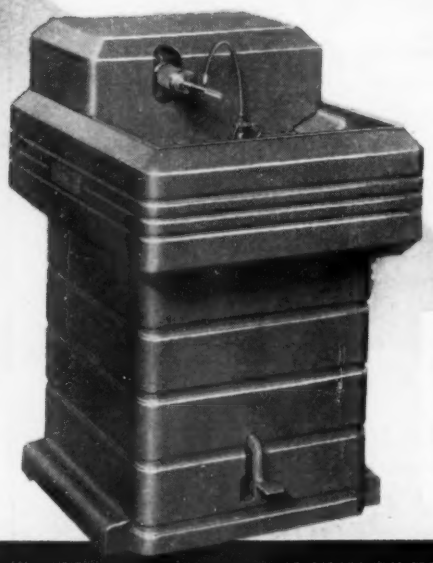
GISHOLT

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

WHEN IT COMES TO . . .



PRECISION THREAD GRINDERS—Ex-Cell-O makes nine styles of precision thread grinding machines, making it possible for each manufacturer of hardened threaded parts to select the exact type of machine required to handle his precision threaded work most successfully on a profitable production basis.



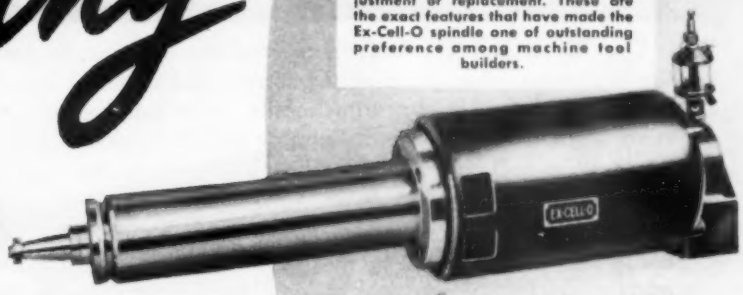
CARBIDE TOOL GRINDERS—(Above) One of six styles of Ex-Cell-O precision-built tool grinders designed to refinish carbide-tipped and cutting tools of other materials. The machine illustrated is Style 44.

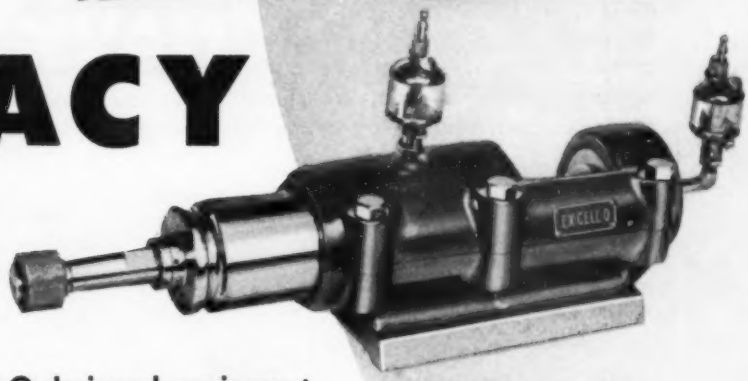
PRECISION LAPPING MACHINES—*(Above)* Ex-Cell-O Style 74 for Center Lapping. With smooth, correctly shaped centers on workpieces, readily obtained through the use of this machine, greater precision can be assured when using grinding equipment. *To left:* Ex-Cell-O Style 71 Internal Lapping machine for lower cost precision finishing of plain straight holes and holes with interrupted openings.

PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • SPECIAL PRECISION DRILLING MACHINES • TOOL GRINDERS • HYDRAULIC POWER DRILL JIG BUSHINGS • DIESEL FUEL INJECTION EQUIPMENT • PURE-PAK

Grinding WITH ACCURACY

Grinding on today's high and steady production basis places a heavy demand on the grinding spindle. It must be one that assures minimum end and radial play, as well as one that develops and maintains all the speed that's required for the job in hand, and accomplishes this for long periods of time without bearing adjustment or replacement. These are the exact features that have made the Ex-Cell-O spindle one of outstanding preference among machine tool builders.

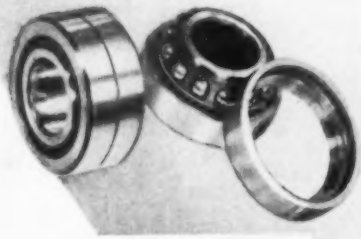




CONSIDER EX-CELL-O *Precision* EQUIPMENT

Today's grinding practice brings Ex-Cell-O designed equipment right to the front. Ex-Cell-O precision-made products now entering far into the grinding field have made possible worthwhile improvements in methods to attain mass production with accuracy. There is the Ex-Cell-O thread grinder, introducing commercially a new precision process to American industry; the Ex-Cell-O tool grinder, bringing new efficiency in the grinding of cutting tools of carbide, stellite, and high speed steel; the Ex-Cell-O lapping machines for properly preparing female centers for grinding, and for the rapid precision finishing of small holes; and there is the Ex-Cell-O grinding spindle, widely used by the builders of internal, surface and universal grinding machines, for both original equipment and replacement. In the manufacture of all these products, only one standard exists at Ex-Cell-O—the best that highly trained engineers and skilled workers can produce.

If you have a grinding problem, consider the equipment illustrated on these pages—the Ex-Cell-O name on each machine is positive assurance of it being a precision-built product to do a real precision job.



The greater accuracy, increased production, and better finish that a large number of industrial firms are obtaining today on machine tools equipped with the Ex-Cell-O Precision Spindle can, to a great extent, be attributed directly to the superior features of the Ex-Cell-O spindle ball bearing. These features include special methods developed and patented by Ex-Cell-O for precision fitting of the ball bearings.

EX-CELL-O CORPORATION • DETROIT

XLO

EX-CELL-O *for* PRECISION

MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE UNITS • GRINDING SPINDLES • BROACHES • CONTINENTAL CUTTING TOOLS CONTAINER MACHINES • R. R. PINS AND BUSHINGS • PRECISION PARTS

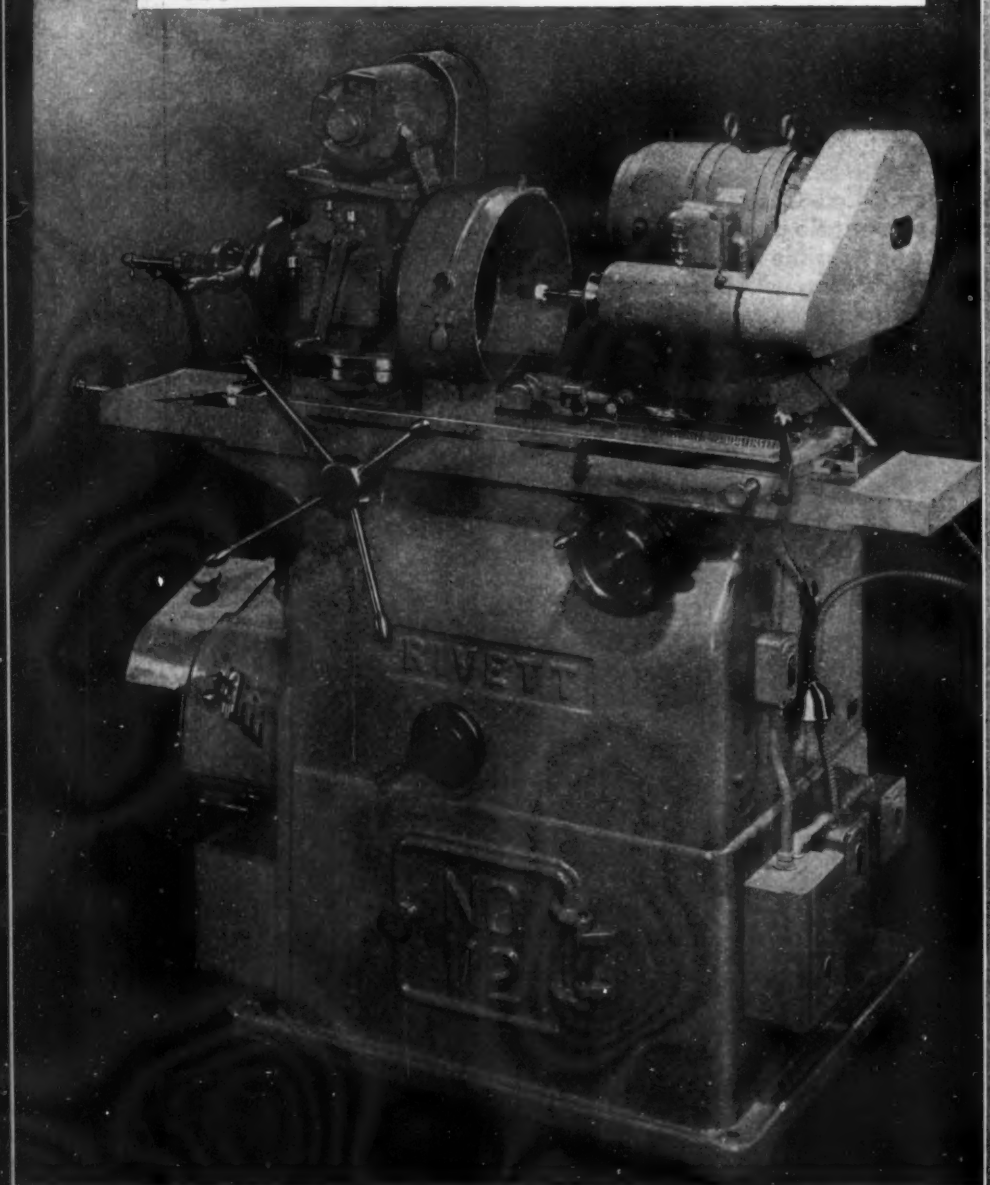
RIVETT

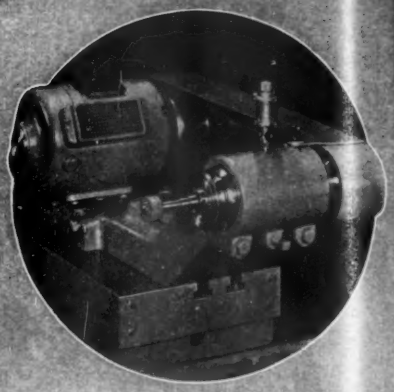
112 UNIVERSAL GRINDER

For Straight, Taper, Bevel or Straight and Bevel Grinding

The Rivett No. 112 Universal Precision Grinder is primarily for tool-room work. Available internal and external spindles in combination with many adjustments make possible a great variety of grinding operations. Extreme simplicity of design enables any mechanic familiar with grinding to operate the machine.

Work may be held in collet, chuck, face plate or fixture and driven at required speed. Power table reciprocation may be set at one of eighteen selective speeds from 18 to 86 passes per minute. Length of table travel is adjustable between ½" and 8". High or low speed internal spindle bracket or external spindle bracket, all as above, may be mounted as required on cross slide. Workhead, table and cross slide are swivelled individually or in combination for taper and bevel grinding.





High Speed Internal Spindle

External Spindle and Tailstock

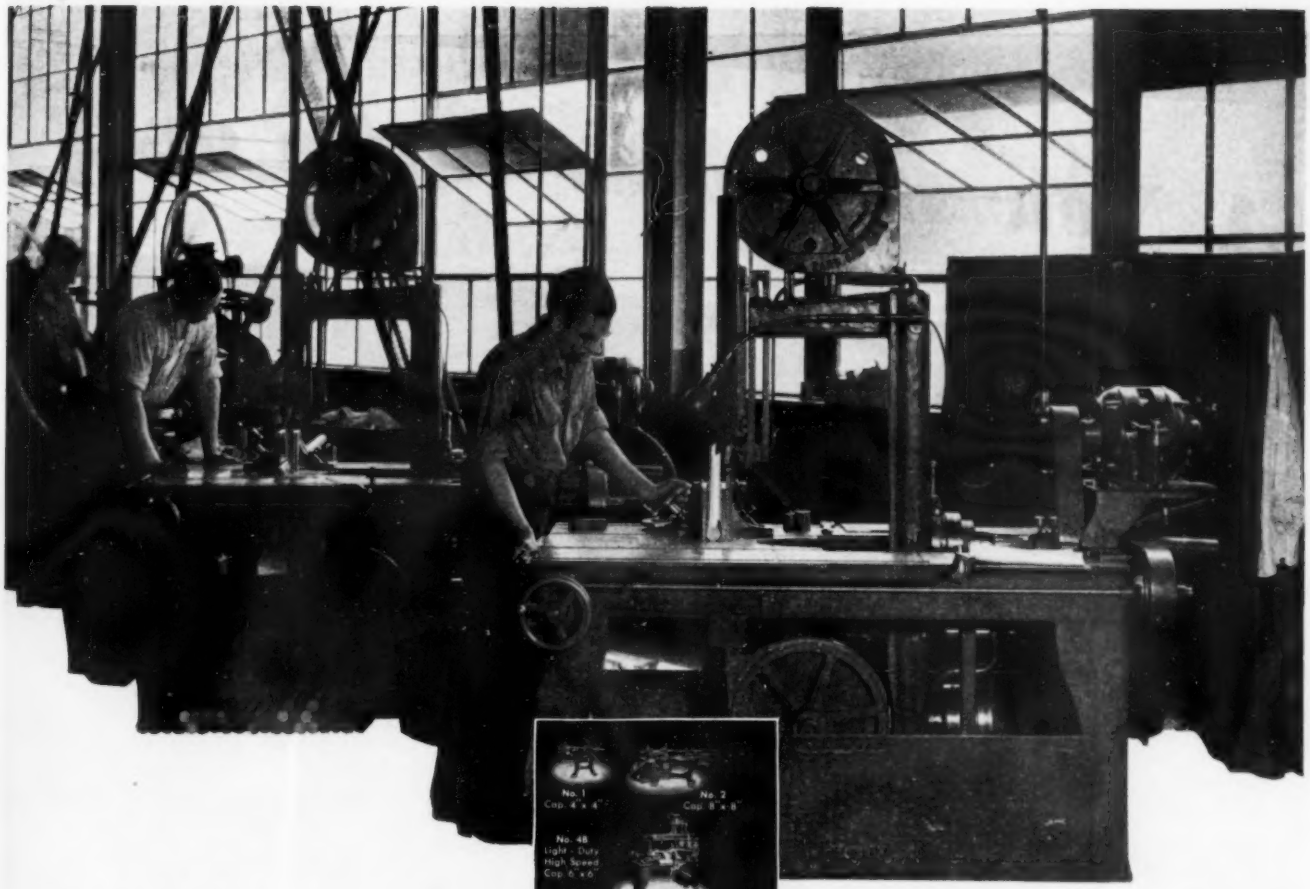
SPECIFICATIONS

Grinding cap., hole dia.	⅛" to 8"
Grinding cap., outside dia.	up to 8"
Automatic table travel	½" to 8"
Table speeds	18 selective
Hand table travel	16"
Swing over table	14"
Workhead swivel	90°
Table swivel	5°
Cross slide swivel	90°
Cross feed graduations	.0005"
Travel of cross slide	3½"
Collet capacity	1"
Step chuck capacity	8"
Jaw chuck capacity	8"
Workhead spindle speeds	150, 380, 500 r.p.m.
Grinding spindle speeds:	
Standard int.	4600 and 10000 r.p.m.
High speed int.	25000 r.p.m.
External	3300 r.p.m.
Automatic Oil Lubrication	
Net weight with motors	3700 lbs.

For Further Description Write for Bulletin 112

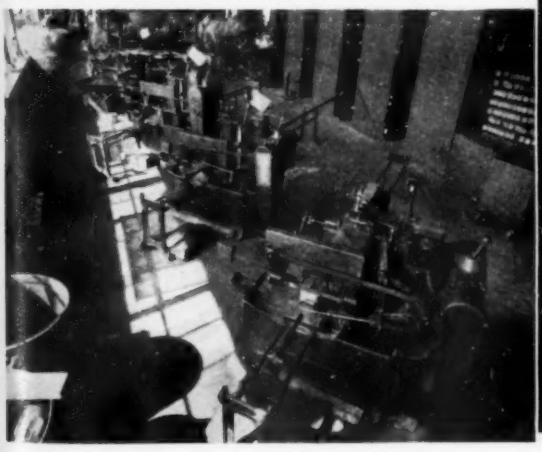
RIVETT LATHE & GRINDER INC.

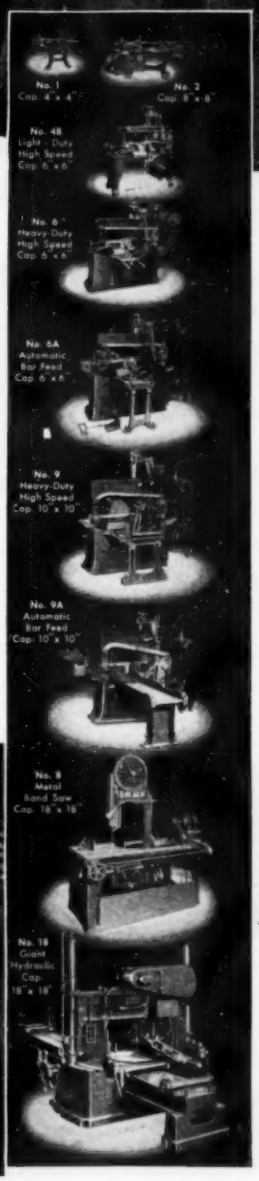
BRIGHTON BOSTON MASS



Tool Makers know it takes good tools to make good tools

In almost every leading tool manufacturing plant, as in the Chicago plant illustrated here, they have standardized on MARVEL Metal Sawing Equipment. (Above: MARVEL No. 8 Metal Cutting Band Saws. Below, a battery of MARVEL No. 6A High Speed Production Saws.)





A COMPLETE SYSTEM OF METAL SAWING

The MARVEL System of Metal Sawing provides exactly suited saws for every shop or department. Included in the System are: Low priced dry-cutting general purpose shop saws; a light duty high speed shop saw; heavy duty, all-ball-bearing speed saws (the fastest saws built); heavy duty production saws with automatic bar push-up; versatile all-purpose metal cutting band saws of large capacity; a new giant hydraulic hack saw designed for the largest sizes and toughest alloys . . . and the positively unbreakable MARVEL High-Speed-Edge Hack Saw Blades.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

Eastern Sales: 225 Lafayette St., New York City

5700 Bloomingdale Ave. Chicago, U. S. A.

A New Operator takes over

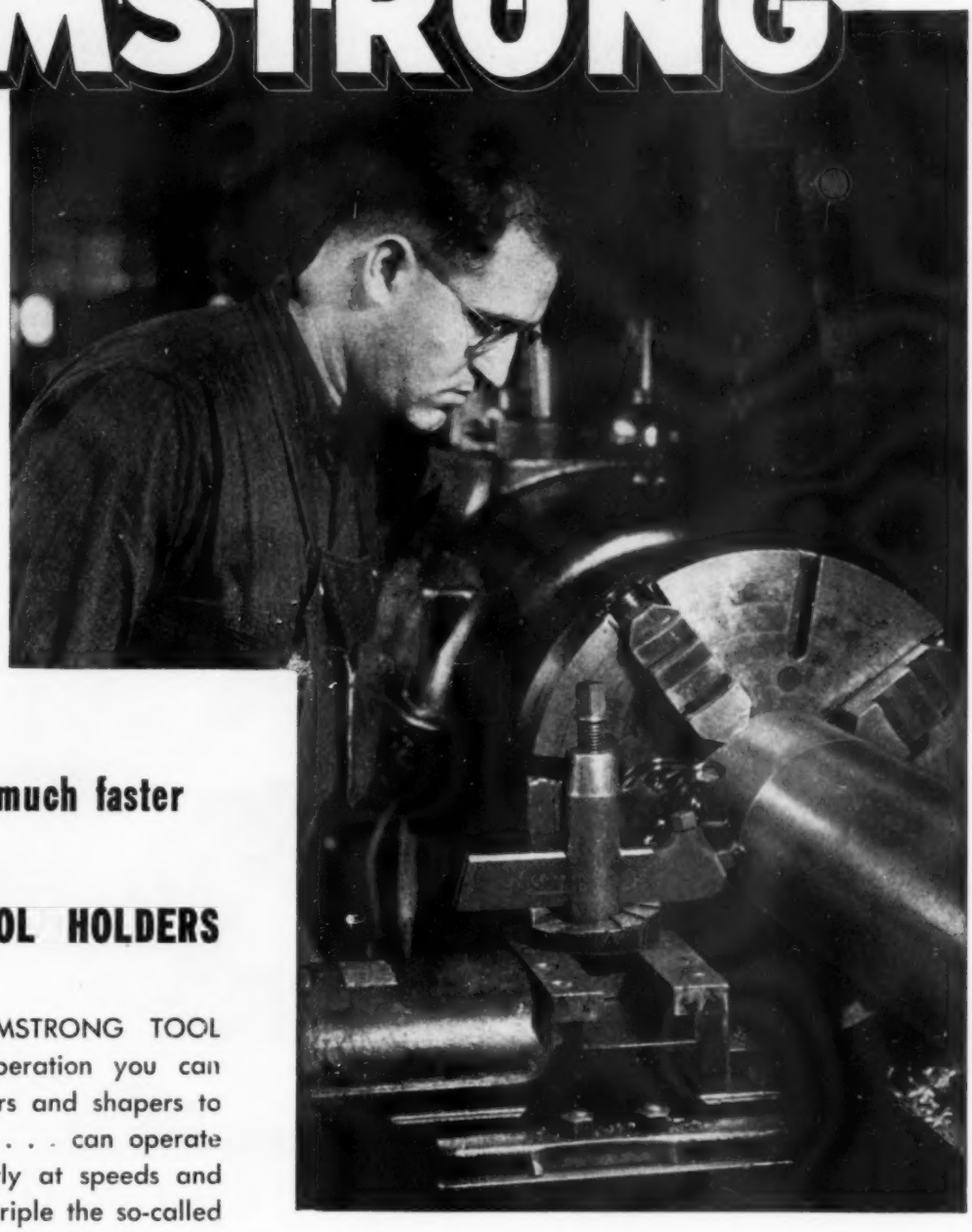
THE essential features of the Sellers Heavy Duty Tool Grinding Machine—simplicity, accuracy, uniformity—are of greater value today than ever before. They permit the operation of these versatile, high production precision tool grinders by newly trained and relatively inexperienced personnel. Even women operators on these machines can grind any cemented carbide or high speed steel, straight or convex curved face tools, including thread tools of any angle of thread or pitch, internal or external, and can accurately reproduce the desired angles or clearances on all the tools. They keep production moving.

WILLIAM SELLERS & CO., INC., PHILADELPHIA, PA.

FOUNDED SELLERS 1848

Sellers

ARMSTRONG



You can machine much faster with the correct ARMSTRONG TOOL HOLDERS

With the correct ARMSTRONG TOOL HOLDERS for each operation you can speed up lathes, planers and shapers to their absolute capacity . . . can operate safely and cut efficiently at speeds and feeds often double or triple the so-called "standard" speeds . . . can produce many more pieces per machine-hour and many more pieces per man with your present force and equipment.

Now is the time this extra production is needed . . . is the time to get the *utmost* from every working hour. It's time to use the correct ARMSTRONG TOOL HOLDER for every operation so that your machine tools can deliver their absolute maximum.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"

315 N. Francisco Ave. Chicago, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., New York

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

LOST-TIME-EYES
are Tragic for Your Workers... Costly to You!

...Gain Doubly by Stepping Up Your Goggle Program

Listen to this worker: "Without any warning, something sharp hit me in the eye. Doubled me up. I've suffered a lot... so has my family. Lost lots of time. Even now, I can't do the work I've been *trained* for. Cost the company plenty, too."

Yes, this lost time eye accident *did* cost the company *plenty* . . . in doctor's bills, medical supplies, in lost man-power, wasted production, lowered workers' morale. Every eye injury is costly—in many ways. And the biggest part of the tragedy is that most injuries can be prevented by a pair of scientifically designed, easy-to-wear AO goggles.

American Optical Company makes a type and size goggle suitable for every man and woman in your plant who needs eye protection. For detailed information, practical safety suggestions, and efficient co-operation, call in your AO Safety Representative today. He is located in a Branch office near you.

ARMY E NAVY

American Optical

COMPANY
SOUTHBRIDGE, MASSACHUSETTS

Manufacturers for 110 Years of Products to Aid and Protect Vision. Branches in All Principal Industrial Centers

Built for the generation of precision threads
Proved in the War plants of America . . .

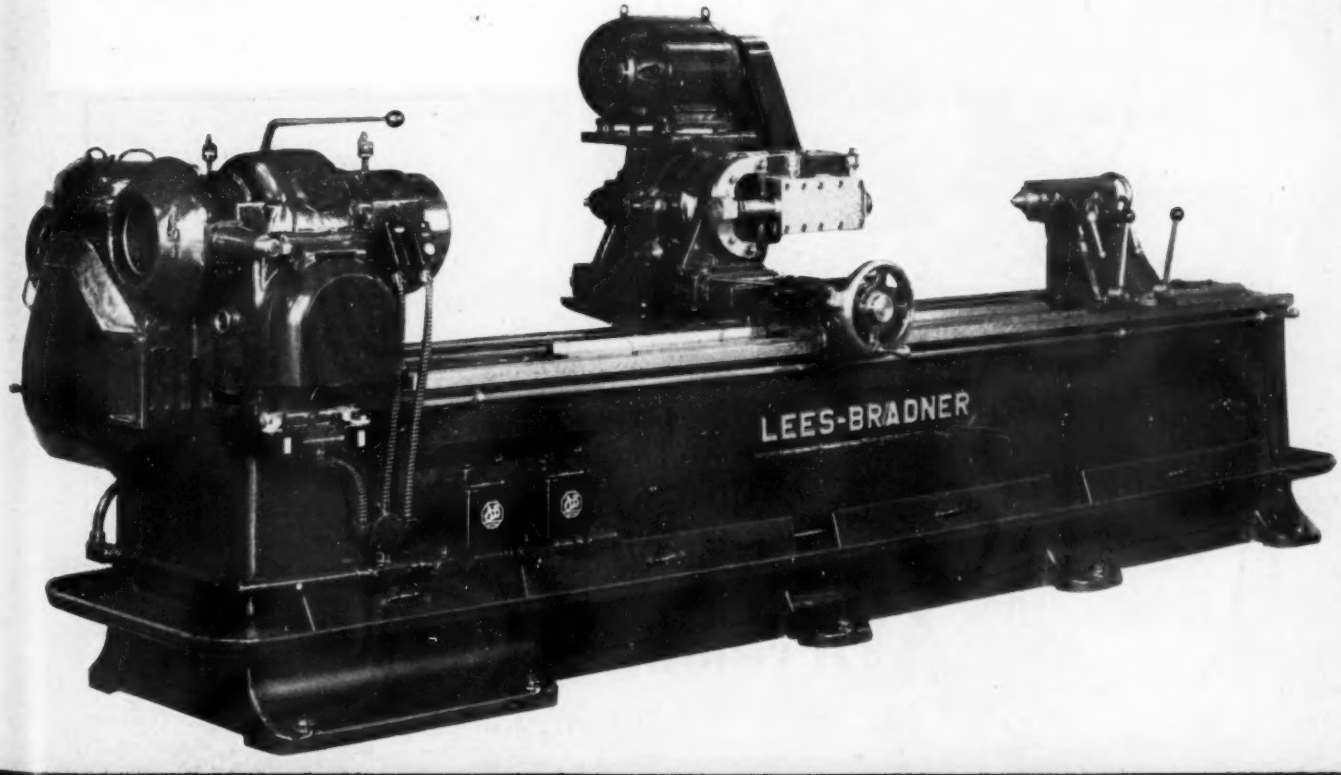
THE LEES-BRADNER

Heavy Type
THREAD MILLER

The Lees-Bradner HT Thread Miller is operating successfully in hundreds of plants producing airplane—tank—and cannon parts to prescribed tolerances at a production rate far beyond expectations.

Where accuracy, finish and high production are of first importance on your threading operations—put the job on a Lees-Bradner HT Thread Miller.

Our Engineers are available for consultation on your precision threading jobs.



The LEES-BRADNER *Company*

CLEVELAND, OHIO, U.S.A.

Yesterday—*Only true pioneers and thrill seekers would ride in the rickety "egg crate" plane. Yet that plane, with all its crudities, was a giant step in human progress and transportation. Without early abrading, processes such as grinding, it would have been impossible.*

Today—The giant air liner is a tremendous improvement on the plane of yesterday—as is the modern fighter or bomber over the planes of World War I. HONING—the advanced abrading process—helped to make this improvement possible. Safety, lightness, long operation without overhaul—all are dependent to some degree on HONING.

Tomorrow—We do not know what course the progress of air transport will take. But whatever it is, there will be greater need for better controlled machining processes.

Micromatic has developed the HONE ABRADING process to be ready for these advanced requirements. At present, HONING application is limited to serious war needs. Tomorrow, it can expand with many new applications already developed.

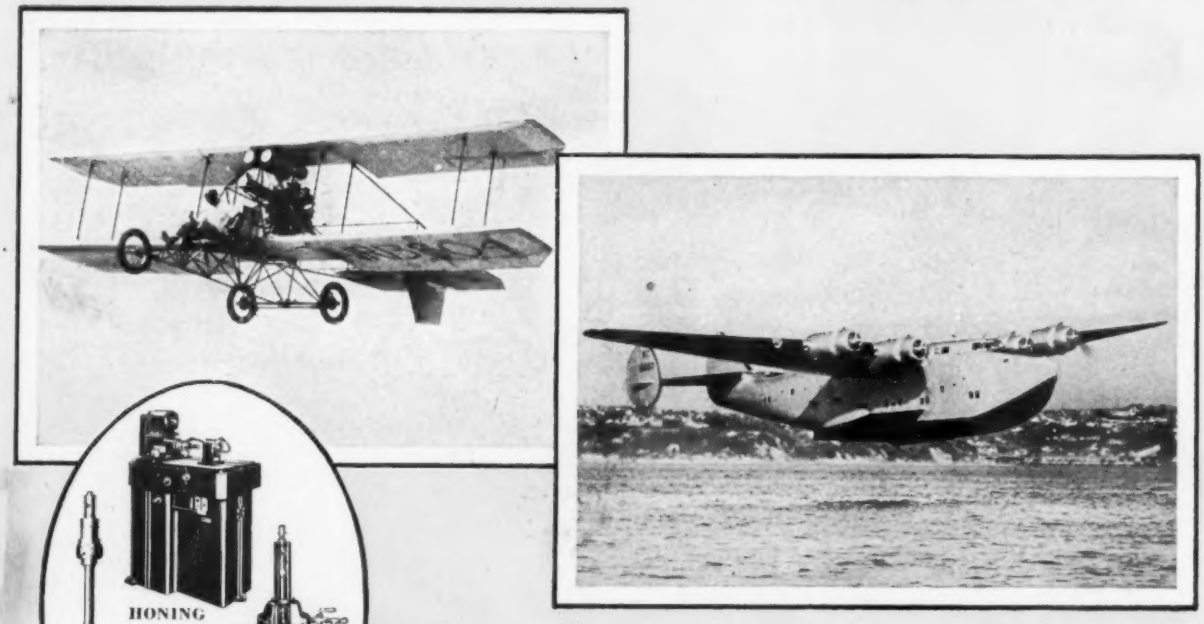
HONING

helped to develop yesterday's

"EGG CRATE" Plane

into the

SAFE, MODERN AIR TRANSPORT



Micromatic HONE CORPORATION

Detroit, Michigan

MAKERS OF HONING MACHINE TOOLS

HONING helped create "400" Aviation

The tactical need for outflying our enemy has crowded military aviation into the "400" bracket, as may be seen in the comparison below:

	WORLD WAR I	WORLD WAR II
Speed	130 MPH	400 MPH
Period Between Engine Overhauls	40 Hours	400 Hours
Tactical Ceiling	12,000 Feet	40,000 Feet
Engine HP	125 HP (Liberty)	2,000 HP

This amazing advancement has been accomplished largely by better engineering design, better metallurgy and better controlled machining. Microhoning provides one of the most important machining controls by assuring maximum quality and safety in the bearing surfaces of our military and naval plane engines and other plane mechanisms.

Bearing bores and other critical surfaces are finished by Microhoning—the modern abrading process which removes stock at rates up to 65 cubic inches per hour, generates accuracy for roundness and straightness of bore within .0002″ to .0003″ and any desired surface finish.

Better planes for war mean better planes for the peace to come.

Some Microhoned Aircraft Bores

Engine Cylinder Barrels

Master Con Rod (all bores)

Articulated Rod (all bores)

Piston Pin Bores

Valve Guide Bores

Pinion Gear Bores

Oleo Cylinder Bores

Brake Cylinder Bores

Gun Turret Hydraulic Cylinder Bores and many other parts

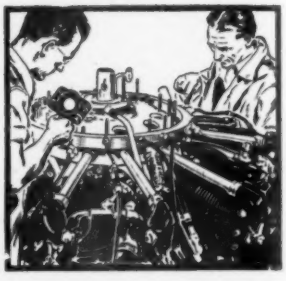
MICRO MATIC

MICROMATIC HONE CORPORATION

DETROIT, MICHIGAN

MAGNI-RAY

aids accuracy, saves time and quickly detects trouble—an instrument of wide utility



MAGNI-RAY — a wide field, illuminated magnifier for close inspection of tools, work and operations — gives clear, undistorted magnification combined with strong concentrated illumination.

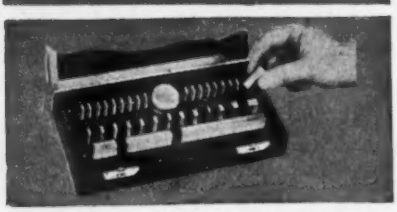
In addition to the typical uses shown here, MAGNI-RAY provides an effective, simple means of reading micrometers down to one-tenth graduations as well as verniers, accurately and clearly.

Developed to meet the many needs in the shop where eye aid can promote accuracy and speed operations, MAGNI-RAY increases personal efficiency in tool room, inspection, drafting, assembly. Because it is an instrument of almost countless uses on precision work of all kinds, it meets many definite needs.

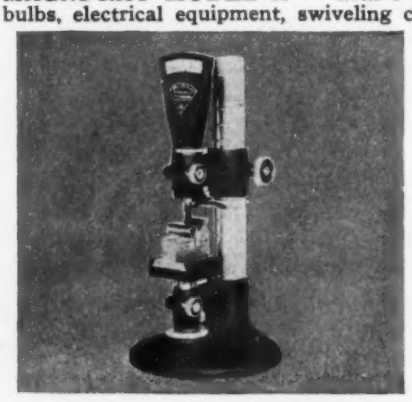
MAGNI-RAY MODEL A — with 3 inch optical glass lens, complete with two bulbs, electrical equipment, swiveling clamp and stand — Price $18.50. MAGNI-RAY MODEL B — with achromatic lens magnification field of 2 inches and magnification power of 3 plus, complete with bulbs, electrical equipment, swiveling clamp and stand — Price $27.50.

Speed Your Inspection by Ordering Today!

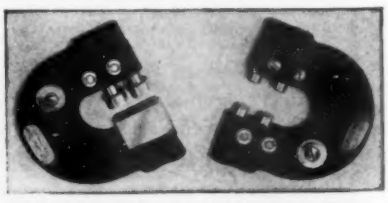
OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY



Ultra-Chex—a 34 block set accurate to .000008" and providing a basic standard of measurements.



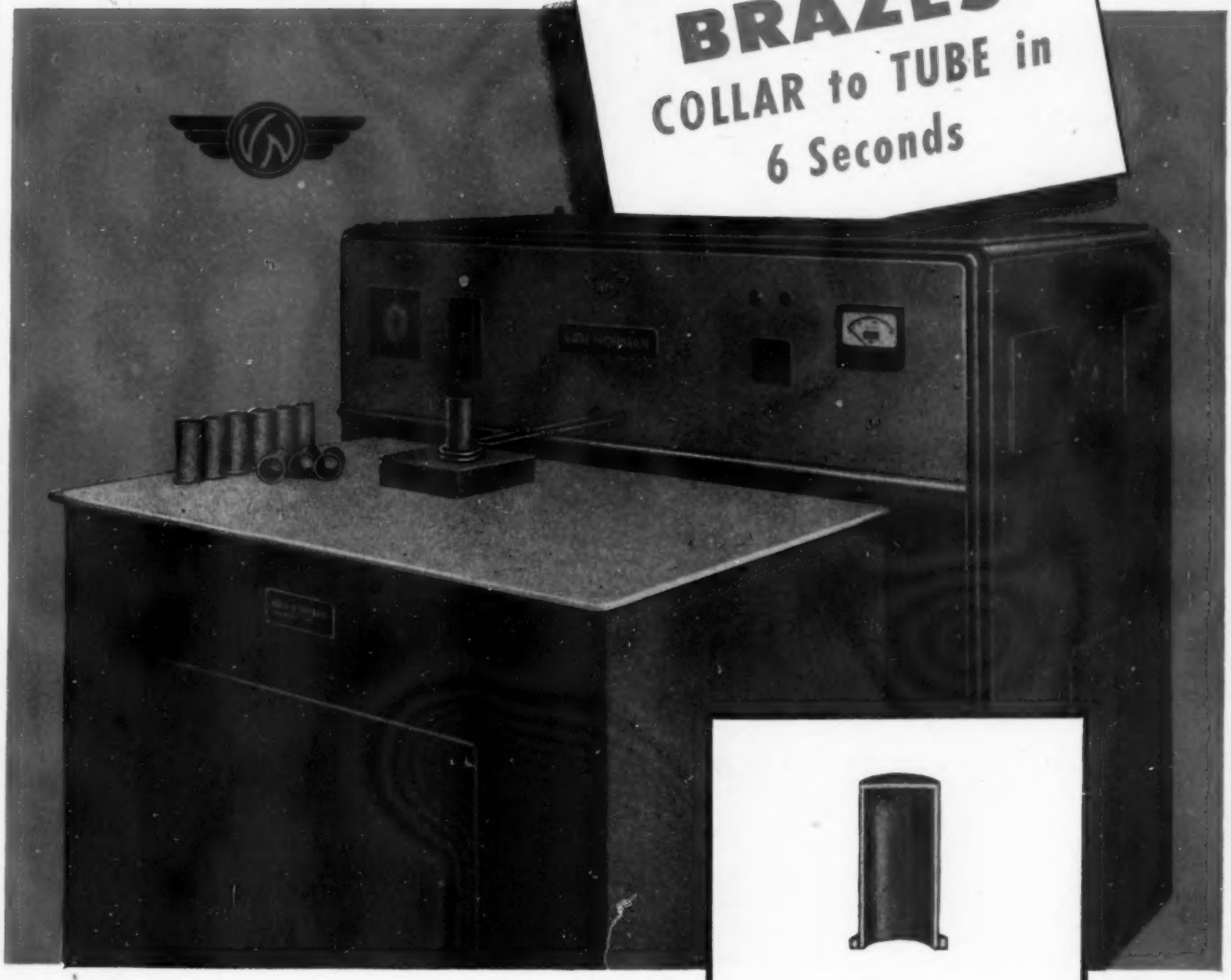
Scherr Comparitol — for checking gage blocks, gages and work for size, accuracy and wear.



Atlantic Adjustable Limit Snap Gages —for accurate check-up, without having to depend on operator's skill. Sizes to 6".

GEORGE SCHERR COMPANY, INC. 124 LAFAYETTE ST., NEW YORK, N.Y.

VAN NORMAN HIGH FREQUENCY INDUCTION HEATING



Section of tube brazed by Van Normanizing. Heating time—6 seconds.

In the illustration, collars are brazed to tubes in 6 seconds with Van Norman High Frequency Induction Heating. Bonds are clean, tight and uniform. The finished part has no discoloration and is free from scale, thus cleaning operations, which are usually necessary when torches and other brazing methods are used, are eliminated, spoilage is minimized, and piece after piece is brazed with the same uniform results. Obviously, VAN NORMANIZING produces a better finished part, speeds output and reduces costs.

By using the proper work-holding fixture and heating coil, a number of workpieces can be brazed simultaneously. Odd-shaped parts are just as easily brazed by Van Norman High Frequency Induction Heating as uniform parts.

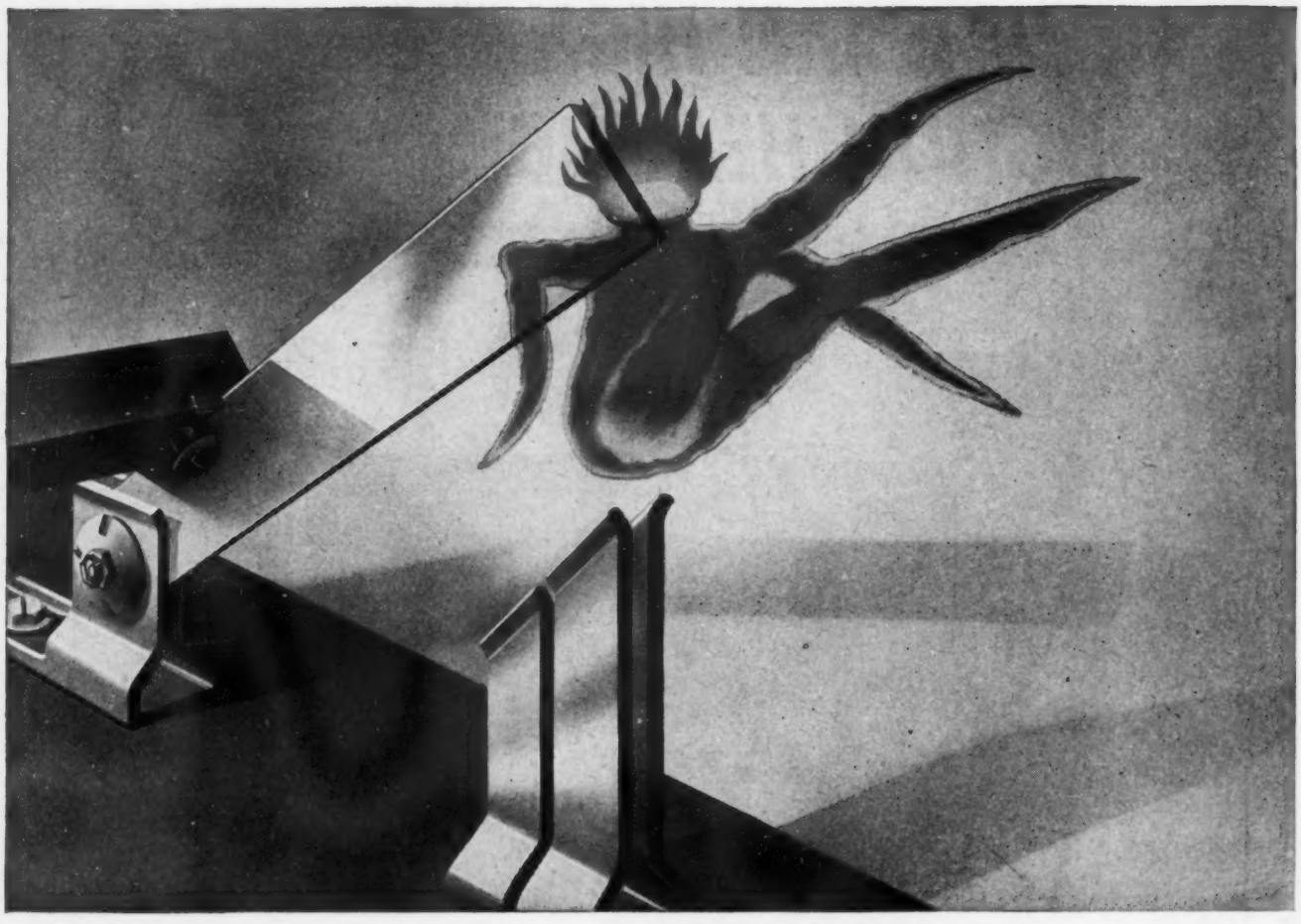
It will pay you to investigate Van Norman High Frequency Induction Heating for Hardening, Brazing, Soldering, Annealing and other applications requiring localized heat.

"It pays to Van Normanize"

ARMY E NAVY

VAN NORMAN MACHINE TOOL CO.

SPRINGFIELD, MASSACHUSETTS



hot arcs get the point Quick!

Arcs burn with terrific heat when they leap between opening contacts. The heavier the load... the hotter they burn. Switch contacts get badly pitted and burnt, unless the arc is both controlled and extinguished, *quick*.

Westinghouse Safety Switches eliminate this source of trouble. The diamond-pointed jaw carries the arc outside the contact area assuring long contact life.

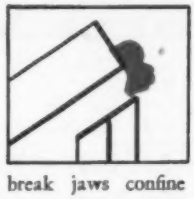
On Safety Switches, 575 and 600 volts, Westinghouse adds another protective plus—the "De-ion" arc quencher. This exclusive feature draws the arc up into the grids—divides and extinguishes it in the blink of an eye.

These advantages mean better, more dependable protection. Contacts stay clean, last longer. Time-outs for maintenance and inspection reduced.

Protect your important circuits with Westinghouse Safety Switches. Ratings up to 1200 amps, 600 volts. Call your Westinghouse representative today. Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa., Dept. 7-N.

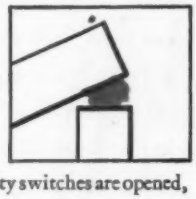
J-21266

LIKE THIS



Diamond-pointed break jaws confine arcing to the point... force the arc to break outside the current carrying areas. Contact surfaces stay clean, don't pit and burn.

NOT LIKE THIS



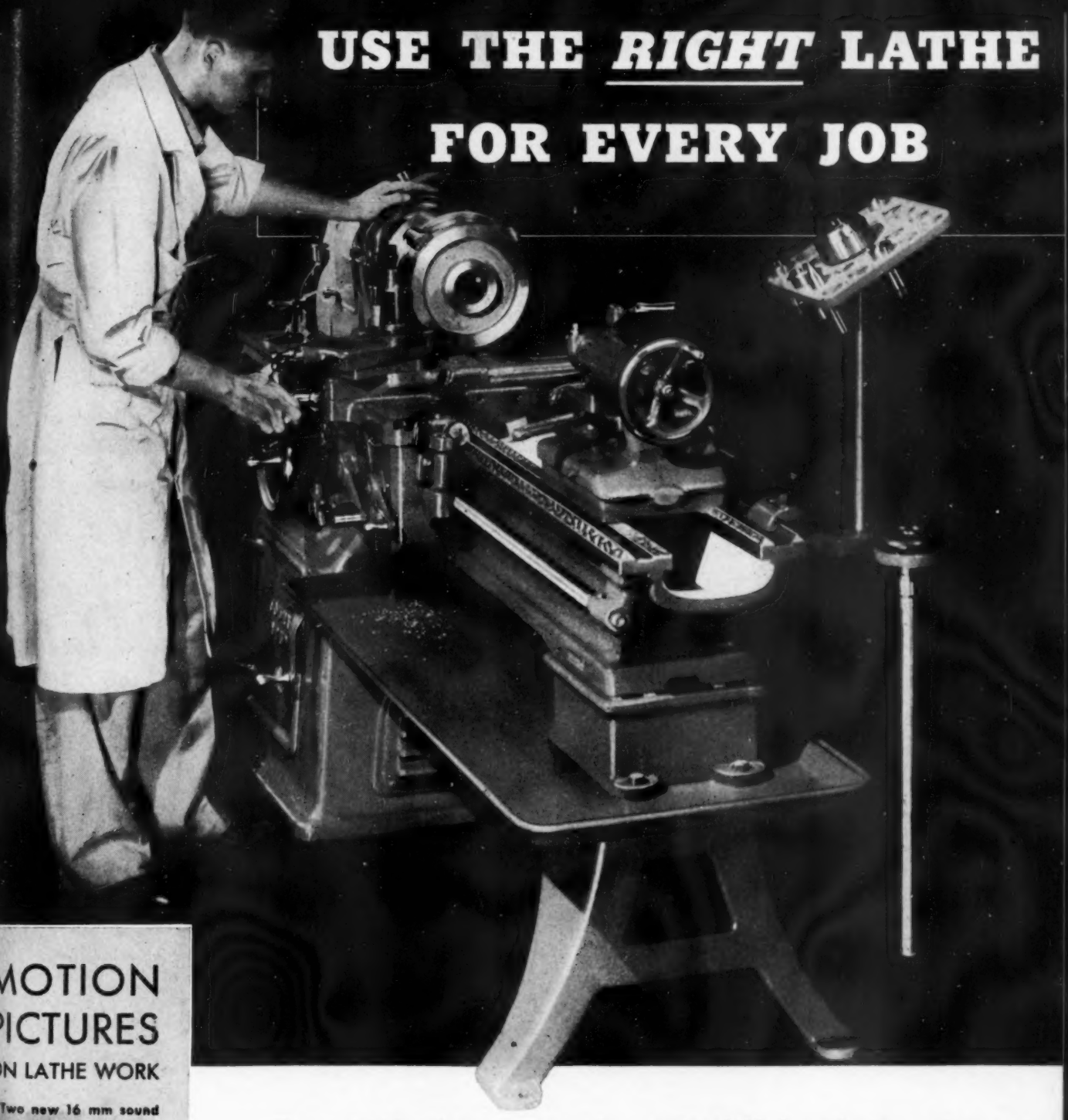
When ordinary safety switches are opened, the arc leaps across the contact areas . . . along the jaw and blade. It hangs on longer, burns and pits the contact surfaces.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

SAFETY SWITCHES

USE THE *RIGHT* LATHE FOR EVERY JOB



MOTION PICTURES ON LATHE WORK

Two new 16 mm sound films in full color are available on a free loan basis for lathe apprentice training in the war industries.

Professionally filmed in our own factory under the direct supervision of competent lathe operators, these pictures clearly show the basic principles of engine lathe operation.

Showing time for each film is approximately 20 minutes. Write today for complete information.

Time, material and manpower can be saved for vital work if you use the *right* lathe for every job. The matching of the job and the lathe has never been more important than today—in no other way can maximum production be obtained. There is no place in our war production effort for slow, obsolete machines of questionable accuracy.

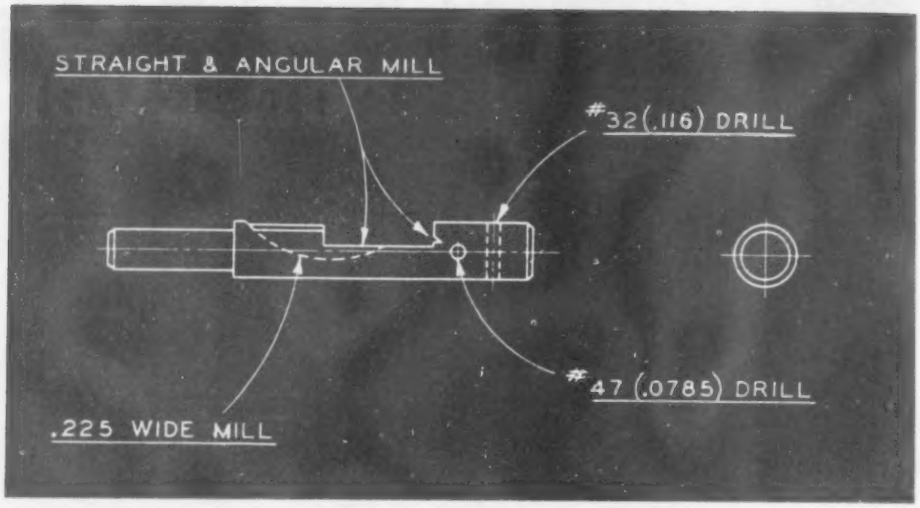
This is proved every day in hundreds of war plants where competent engineers have matched jobs with South Bend Lathes. Their speed, accuracy and ease of operation increase output, hold close tolerances, and conserve manpower for more efficient production.

There is a South Bend Lathe for practically every class of machine work. Toolroom Lathes and Engine Lathes are built in five sizes: 9″, 10″, 13″, 14½″, and 16″ swings. South Bend Turret Lathes are built in two sizes: Series 900, and Series 1000. A wide selection of attachments, accessories and tools are available for special classes of work. Write for information, specifying size and type of lathe in which you are interested.

ARMY E NAVY

SOUTH BEND LATHE WORKS

SOUTH BEND, INDIANA — LATHE BUILDERS FOR 36 YEARS



THIS IS A

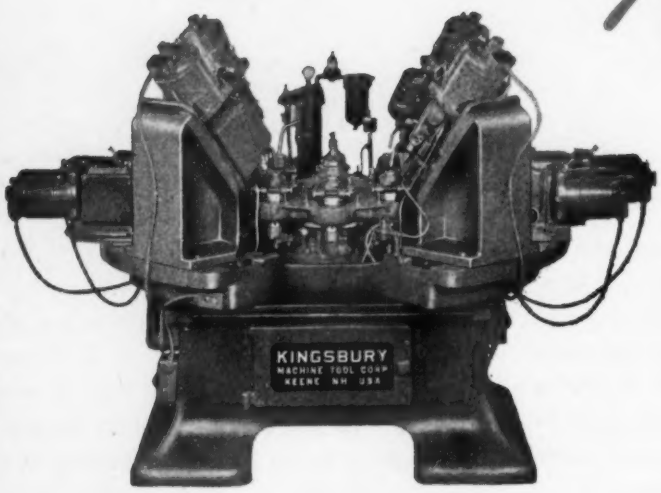
FLEXIMATIC

SMALL ARMS JOB!

Turning out rifle bolts to exact specifications under a fast production schedule

FLEXIMATIC

by KINGSBURY



Many vital needs of armament production are being met with FLEXIMATICS—the machines which perform a wide variety of machining operations in a single chucking of the work.

The Model GD FLEXIMATIC shown here performs various drilling and milling operations on rifle bolts—a job that calls for the highest in both precision and production.

Contributing to the accuracy of the operations performed on this FLEXIMATIC is the mounting of milling spindles on Timken precision bearings. Further safeguarding of accuracy is achieved through driving each spindle by a cone worm and worm gear and dampening vibration by means of a heavy fly-wheel.

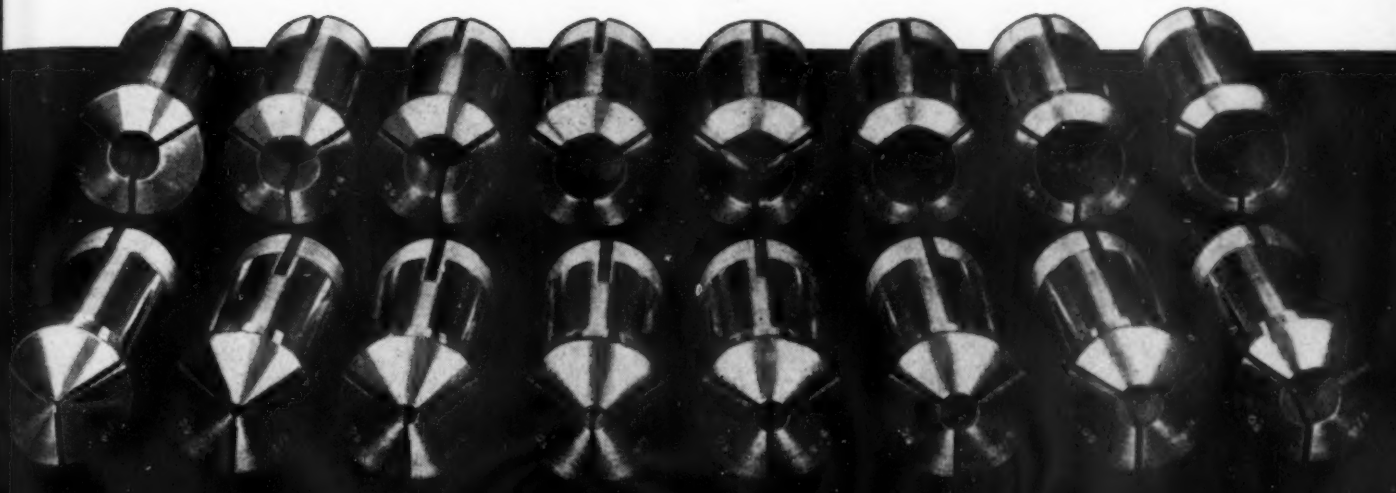
FLEXIMATICS are ideal for all classes of armament production where high accuracy and fast production with unskilled labor are every day conditions which must be met. FLEXIMATICS can, therefore, be depended on to make outstanding production contributions to National Defense.

Write today for illustrated Bulletin showing a number of different set-ups

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U S A

Use HARDINGE Collets and get all 3*



* 1. Accuracy
2. Spring Temper
3. Long Life

You are assured of the three essential requisites for proper collet performance when you use **HARDINGE** Collets.

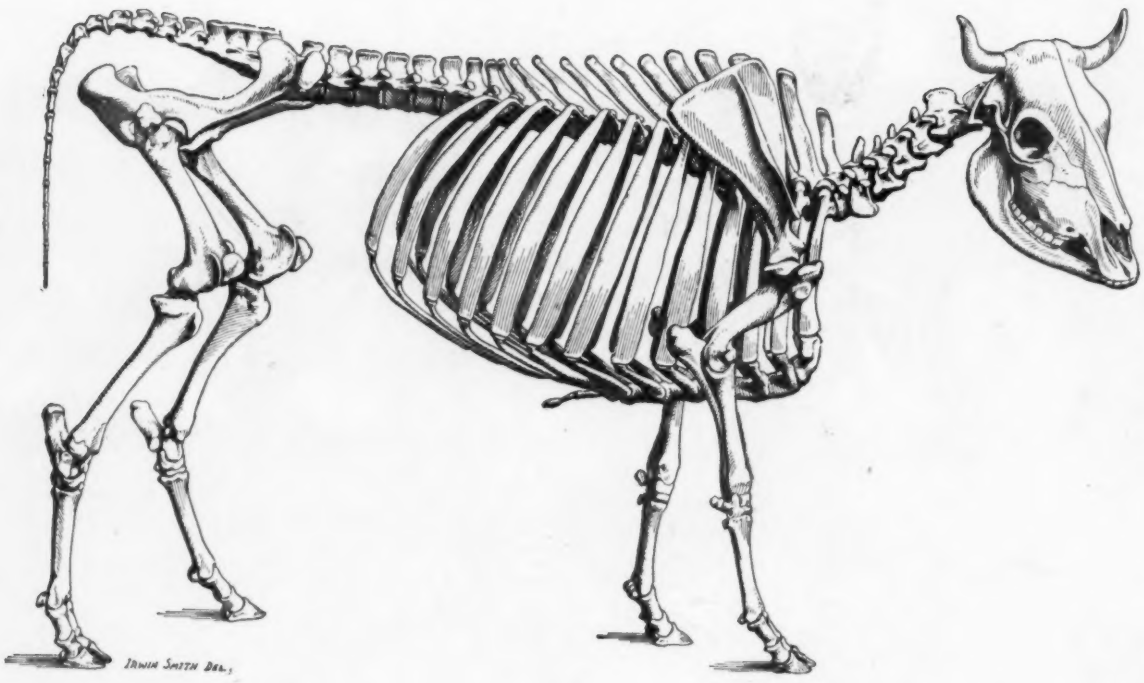
When ordering collets only, or when ordering collets with lathes or milling machines of any make or size — specify **HARDINGE** Collets . . . they cost no more than other Collets.

If you do not have the **HARDINGE** Bulletin No. 41 giving full details, write for your copy today.

PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR

HARDINGE
ELMIRA, N.Y.

THE SKELETON OF A GREAT IDEA



Only 47% of a steer is edible meat. The rest is bones, gristle and other inedible materials.

In the past, meat has been brought to market in carcass form. Countless tons of inedible bones and surplus fat have been transported countless miles...by railroad, ships and trucks. An enormous waste of energy and shipping space!

Today, to save precious shipping space, meat is being shipped to our armed forces abroad de-boned and de-fatted. The skeletons of the steers are being left home.

The U-boats made this change necessary. Modern, high-efficiency refrigeration made it possible.

Steaks and other de-boned cuts of meat are now pressed into compact blocks and refrigerated at low temperatures. Dependable refrigeration equipment has been provided by General Electric for this purpose.

To meet unusual war needs, enormous strides have been made in the development of General Electric *industrial refrigeration* and *air conditioning.*

Equipment is more efficient, more compact, more flexible. When the war ends, these improvements will be applied to peacetime uses and made available to all.

☆ BUY WAR BONDS ☆

General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 438, Bloomfield, New Jersey.

Air Conditioning by

GENERAL ELECTRIC

Listen to the General Electric radio programs: "THE HOUR OF CHARM", Sundays, 10 P.M., EWT, on NBC..."THE WORLD TODAY" News, Weekdays, 6:45 P.M., EWT, on CBS

a lesson from history

The Birth of Precision

• Any schoolboy can tell you what Eli Whitney did for Southern agriculture with his cotton gin. But did you know that this pioneer Yankee craftsman might properly be called the father of modern precision manufacture?

Financial failure of the cotton gin sent Whitney's American ingenuity to work on the manufacture of muskets. Up to that time, each gun and every one of its separate parts were individually shaped. No two parts were alike and if one piece was damaged, a gunsmith shaped a new one from raw stock and filed it until it fitted.

Whitney was the first to make each part exactly like the similar part for other guns and he proved his point by taking ten pieces of each part of a musket to Washington with him when he went in quest of a government contract. While bewigged officials looked on in amazement, he picked parts at random from the heap and put together ten muskets. Incidentally, he won a contract.

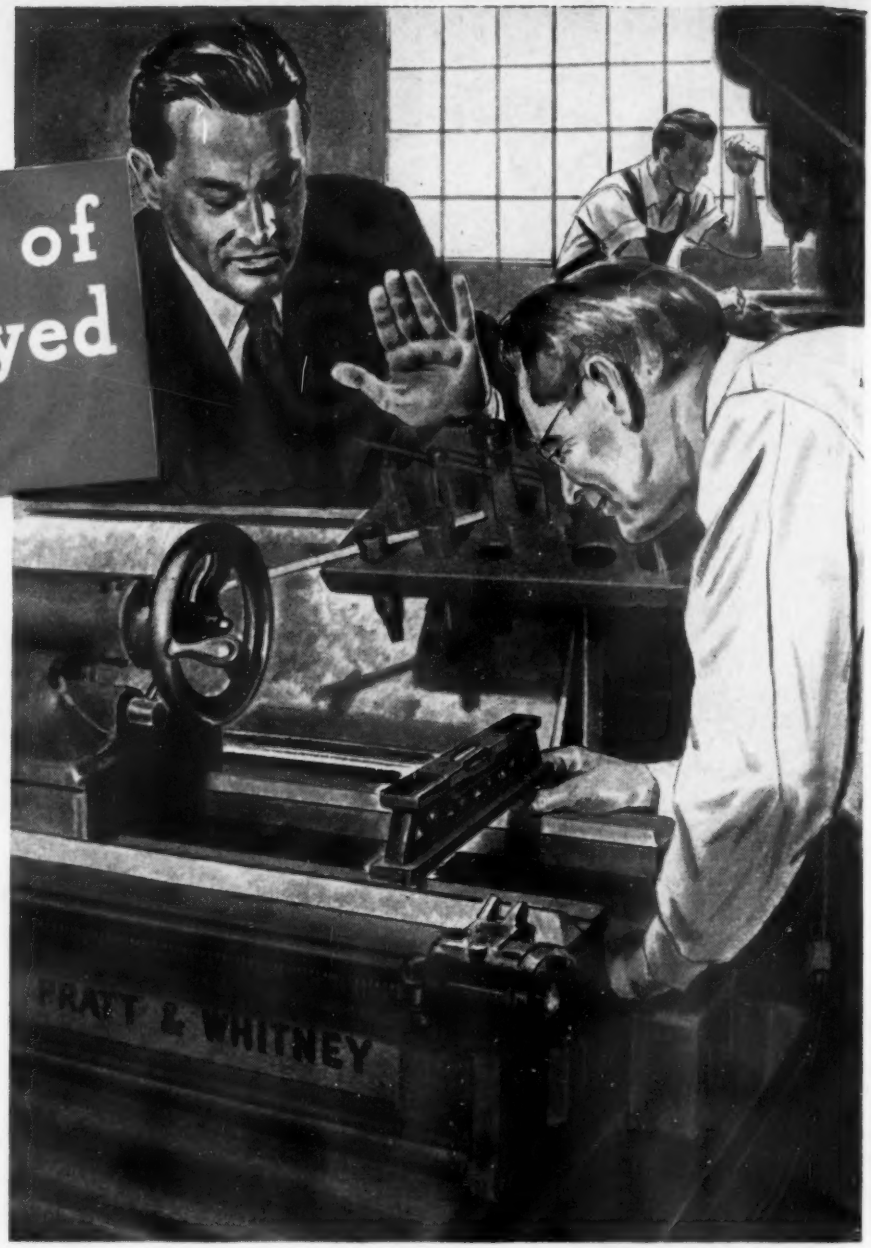
We say incidentally, because what Whitney did that day in 1798 gave birth to modern precision — the same precision that is found today in the manufacture of LeBLOND LATHES. Now, 145 years after Whitney's historic trip to his nation's capital, that same precision is a major factor in winning the war.

THE R. K. LeBLOND MACHINE TOOL CO. • CINCINNATI, OHIO

Largest Manufacturer of a Complete Line of Lathes

NO. 491

The Case of the Cockeyed Lathe



TEN new Pratt & Whitney lathes stood in a neat row—clean lined in their wartime gray. Nine of them were turning out beautiful precision day and night — doing things the Axis won't like. The tenth performed with appalling inaccuracy. It didn't cut straight . . . it cut taper as much as .006" per foot.

That didn't sound right to us. We have high standards, and we maintain 'em. A P&W field engineer went in to check. He took with him a Pratt & Whitney Precision Level — the kind we use to level our own machines. The answer — nine lathes properly level . . . but the tenth was out of level about .012", with a wind in the bed.

Under the guidance of the P&W man's precision level they gradually brought the machine back into line. Result: the lathe cut straight over its entire bed length easily within .0004" per foot . . . a decided improvement! No lemon here . . . just a small razzberry for the man who had installed the machine with a carpenter's level of doubtful accuracy.

* * *

Pratt & Whitney builds fine machine tools of great accuracy, and sees to it that they leave our shop in good condition. While we are building them, the beds and slides and carriages are kept level during all scraping and fitting. If you'll install them accurately level, they'll function with the smooth precision we put there. But if you induce an out-of-level twist, it's no go. Any good machine tool is that way. A carpenter's level* won't do. It pays to recheck the level of your machines often.

And make sure your operator of any Pratt & Whitney machine reads what we say about leveling in the instruction book that was shipped with his machine. It's important.

**Our gage department makes and sells precision levels for just this purpose.*

PRATT & WHITNEY
Division Niles-Bement-Pond Company
West Hartford, Connecticut

PRATT & WHITNEY

MACHINE TOOLS ★ SMALL TOOLS ★ GAGES

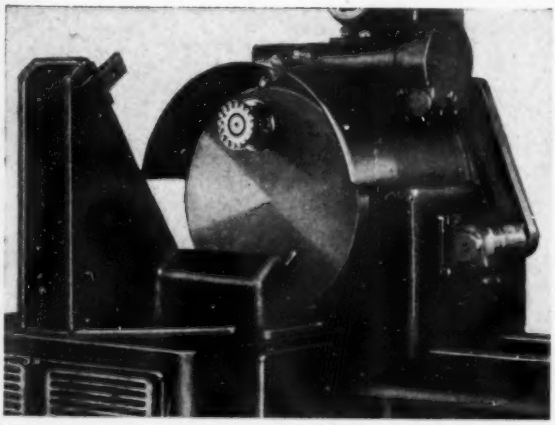
WEST HARTFORD CONNECTICUT

Basic Accuracy for Mass Production

Hydraulic feed and rapid traverse move the cutter head transversely on hardened and ground steel ways. A variety of work fixtures can be mounted on the bed.

CROSS SPECIAL *Floor Type Miller*

Cross' development of a Floor Type Miller with traversing head is of particular importance to the manufacturer who was forced to start quickly and at any expense by improvising with standard machine tools. With exceptional range and flexibility, it is constructed to handle a variety of work with little time required for changeover and set-up. The bed is arranged to receive many different kinds of holding fixtures—vertical, horizontal, angular, indexing, compound, rotary feed, rise and fall. The full automatic operating cycle is controlled from a central push button station and it can be set to automatically perform plain face milling, contour milling, profile milling, slotting, rotary milling, and operations requiring the cutter to traverse an irregular path.



The cutter spindle is mounted in a cradle which can be set to oscillate or rotate thru any predetermined arc. Oscillatory and transverse cutter movements may be synchronized to suit the work.

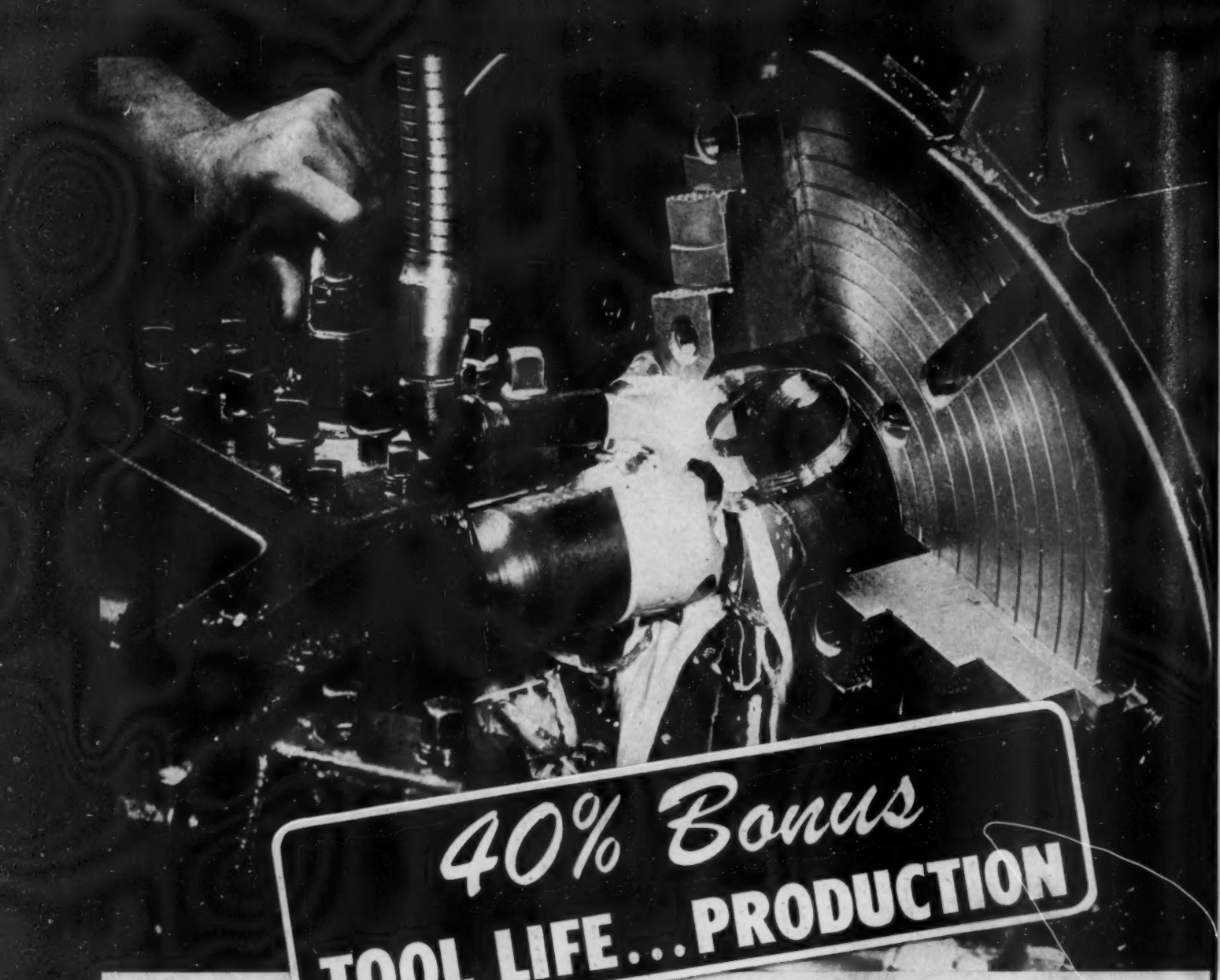
A review of current practice will reveal many opportunities to consolidate operations and put them on an automatic basis with improved accuracy and reduced manpower. Cross engineers are prepared to assist you in applying special machinery to your manufacturing problems.

CROSS GEAR & MACHINE CO.

Established in 1898

DETROIT, MICHIGAN, U.S.A.

S-2



40% Bonus
TOOL LIFE...PRODUCTION

SUNOCO EMULSIFYING CUTTING OIL

prolongs tool life...improves finish...increases production

The longer cutting tools last on the production lines ... the more vitally needed war material can be produced for the fighting line.

The value of the right cutting oil in prolonging tool life was amply proved by a large manufacturer of war material. When using a competitive cutting oil production was seriously slowed down because of short tool life ... poor finish ... and bad operating conditions. Then he switched to Sunoco Emulsifying Cutting Oil on his Warner & Swasey turret lathes. The high heat absorbing lubricating qualities of Sunoco stopped the trouble. Results ... tool life and production stepped up 40% ... finish on parts greatly improved.

From metal working plants large and small on America's production front reports such as these are constantly being received. Facts that prove why the majority of metal working plants flood their tools and work with Sunoco to get more pieces between tool grinds, reduce rejects, and make every man-hour and machine-hour result in peak production. Call in a Sun Doctor of Industry, let him prove the production value of switching to Sunoco in your own plant. Write

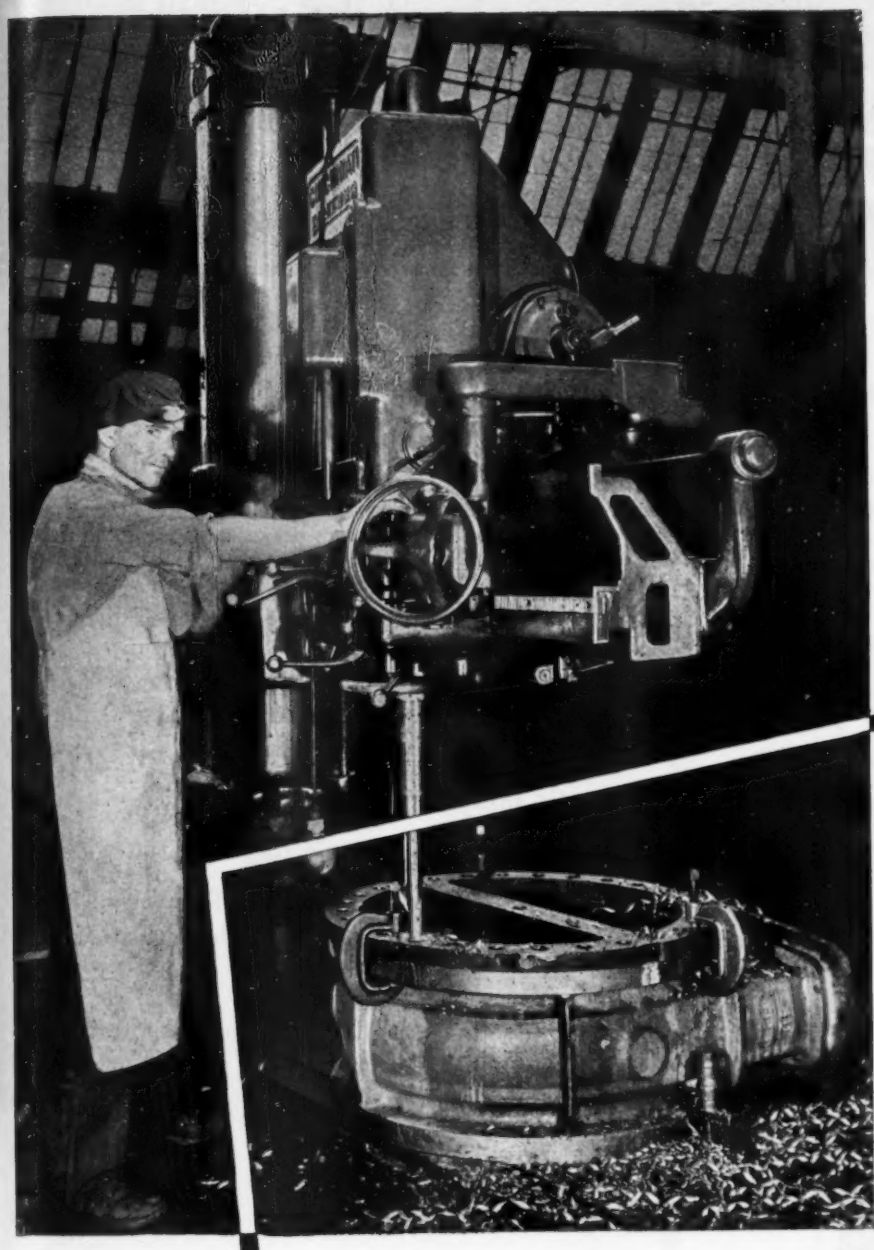
SUN OIL COMPANY, *Philadelphia*

Sun Oil Company, Limited, Toronto, Canada

SUNOCO

SUN INDUSTRIAL PRODUCTS

HELPING INDUSTRY HELP AMERICA



. . and still More Speed

Industry moved pretty fast for "Defense"; now it girds itself for even greater speeds. A Radial Drill which responds to the "all out" demands of industry geared to an unprecedented War production is the Cincinnati Bickford Super Service. In numerous plants batteries of these famous Radials are delivering peak production 24 hours a day, 7 days a week—delivering priceless assets of Accuracy and Absolute Dependability. Cincinnati Bickford designs, aimed at "more-holes-per-dollar", are today proving their value.

• Operations Photograph: Courtesy The Darling Valve & Mfg. Co. Drilling 78 holes, 1⅜" dia. through 2-1/16" cast steel. Floor to floor time 103 min. "More-holes-per-dollar" design nets savings of 15% over machine previously used on this job.

SUPER SERVICE RADIAL

ARMY E NAVY

SUPER CB SERVICE

THE CINCINNATI BICKFORD TOOL CO.

OAKLEY · CINCINNATI · OHIO · U. S. A.

Even the "Experts" Were Stumped
IN A QUIZ ON BAR TURNERS

Do you run into oversized or undersized diameters?

Are you ever troubled with "barber-pole" or "Chinese-writing" finishes?

Ever have a "lump" at the start of a cut?

Ever cuss at the "sloppy fit" of reground cutters?

THE Warner & Swasey Single Cutter Bar Turner sees more service than any other tool used in turret lathe setups for bar work.

Job studies of this tool in action in plants all over the country disclosed to our field men the urgent need for a better knowledge of the mechanical details in the tool itself, and a better understanding of its usage.

Many operators were not getting the best performance from the tool because simple adjustments were overlooked, cutters were improperly ground or wrongly positioned.

This is no reflection upon these operators. Even the master machinist or veteran setup man can learn things about this important tool that he probably didn't know before.

That's why a 32-page booklet about the Single Cutter Bar Turner has been written and is offered by Warner & Swasey as a guide to better finishes and increased production.

This new 32-page booklet just off the press will help eliminate those troubles. It is packed with information, helpful hints, illustrations, and diagrams that will give you a better knowledge of the versatility and capacities of your Warner & Swasey Single Cutter Bar Turner.
BETTER PERFORMANCE
from
Single Cutter Bar Turners

Use the Handy Coupon — Mail Today —It Will Bring the Single Cutter Bar Turner Manual Promptly.

WARNER & SWASEY
Turret Lathes
Cleveland

Warner & Swasey Operator's Service Bureau, Cleveland, Ohio
Please send booklet, "Better Performance from Single Cutter Bar Turners".

Name _____

Address _____

City _____ State _____

I work at (Company) _____

AM-14

YOU CAN TURN IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY

Management
—Heart of America's Industrial Progress

In Peace and War, Management Men and Methods Steer Production on a Steady Upward Course

WHEN the Allied armada of 2,000 ships, protected by a vast umbrella of planes, struck the coast of Sicily, Axis leaders once more had reason to wonder how "that decadent, pleasure-loving America" had swung from the manufacture of automobiles, refrigerators and costume jewelry to equipments of war, and had out-produced such mighty plants as the Krupp, the Fiat and the Skoda works — and had done it so quickly.

America at war is in the lead just as it has led a world at peace. Super-performing planes are taking to the air at the present rate of nearly 100,000 per year. Ships, to carry the war to our enemies, slide down the ways at the rate of two a day. Tanks, trucks, guns, ammunition are pouring out of our "peace" plants in far greater volume than the entire Axis effort can possibly equal. War expenditures in 1943 alone will reach the staggering figure of approximately $83,000,000,000 — an amount equal to our entire national income for 1929. Added to this is the rock-bottom output of essential civilian goods — a very considerable item.

This unprecedented production is taking place while some 9,000,000 men and women, those physically best equipped, have been called to the armed forces. Many of them were taken from industry, and their loss could be repaired only by more efficient equipment and more effective methods.

Rigorous training programs had to be superimposed upon many other abnormal problems facing industry in its high-speed conversion from stoves to boats; from printing machines to guns; from automobiles to airplane engines; from fishing tackle to bomb sights.

This phenomenal task was further complicated by the need for rapid expansion. A modest machine tool industry had to be expanded to handle a volume many times its normal capacity. Steel production had to be increased by 20%, and that of aluminum and magnesium multiplied over and over. From almost nil, the demand for high octane gasoline soared to unbelievable quantities. The creation of synthetic rubber and electronic industries was necessary almost overnight.

Who deserves credit for these accomplishments? All industry! The engineers, chemists, designers, skilled workers, common laborers. But over and above all it belongs to *management*.

In industry it is mandatory to have a directive force to co-ordinate the efforts of men in the use of materials and the application of power toward the production of goods and services. The application of this directive force is the function of management, and only because we had today's kind of management were we able to transform ourselves, almost overnight, from a peace-loving nation to the world's greatest producer of implements of war. As a nation, we had been preparing for a long time to play our part in world affairs. This preparation, certainly not planned for today's objectives but none the less effective, began some four decades ago.

With the advent of the twentieth century, the character of industry in the United States, and, therefore, the character of American living, began to change. Scientific management was born. Frederick W. Taylor brought into focus and showed how to use effectively those processes and procedures upon which our present-day mass production is based. He was followed by Harrington Emerson, who made the industrial world acquainted with efficiency in manufacture and the remarkable progress to be gained therefrom in the field of production, with its consequent price reductions and wider distribution of industry's products. There followed, in industry, an alert management, a capable management, a management with vision. Without it, the work of Taylor and Emerson would have gone for naught.

It is because of this early work of management — and the extraordinary developments it produced — that the country as a whole, and particularly those employed in industry, were not over-awed by the seemingly impossible job of quick conversion to all-out war production. But let us look back four decades and examine some of those preparatory accomplishments which have proven so vital to the progress and welfare of the nation.

From 1900 to 1939 (the last pre-war year), total employment of all kinds increased 52 per cent; in the manufacturing industries alone the increase was 84 per cent. *The nation became definitely industrial.*

In 1900 the average wage earner was able to spend only 20.2 per cent of his income for things other than necessities; in 1930 his buying power for non-essentials had increased to 34.8 per cent. *The average man acquired confidence in what industry could do.*

In 1900 the average work week was 56 hours; in 1930 it was 48 hours. *The burden of production was being transferred from man to machine.*

In 1939 the United States possessed 30 per cent of the world's railroads, 72 per cent of its automobiles, 49 per cent of its telephones. *The nation's production equipment had grown to formidable proportions.*

In 1939 nearly half of the families in the United States owned their own homes, 64 million individuals carried life insurance policies and 45 million had savings accounts. National income had increased 300 per cent from 1900 and during the same period the proportion of national income paid out in salaries and wages increased from 58 to 70 per cent. And in less than this period (1914–1939) the purchasing power of the wage rate increased by 60 per cent. *There had been evolved the kind of living for which men will work — and fight.*

Since 1900, factories increased their output of goods from $11,000,000,000 to $60,000,000,000 in 1939. This increase of nearly 450 per cent was accomplished while the country's population rose only 60 per cent. In this same span of years, technological developments and improvements in methods had

increased the value added by manufacture per wage earner by 200 per cent, and the horsepower per factory worker had been multiplied by 2½. *The nation's production plant was ready to assume its gigantic wartime job.*

During this period of industrial and national evolution, management itself had changed. Prior to the advent of scientific management, our goods and services were the product of several kinds of directive activities, varying from the strictly paternalistic to the ruthless. There was little conception of the responsibility that industry now broadly acknowledges — the responsibility of trusteeship in the interest of stockholders, employees and the public — specifically; in the interest of our national economy — generally. Acceptance of this stewardship is acceptance, also, of the belief that, in the long run, no industry, and no unit of industry, that does not serve society can live.

Have the actions of management caused the times to change? Or has an alert management been successful only because it has changed with the times? Certainly, the industrial concern of 1900 would not thrive under the conditions of today. Just as certainly the new things that industry has in store for a waiting postwar world will have a far-reaching effect upon the times.

Management today seldom owns the factory or the business it manages. It is hired to perform the coordinating, directive functions. It is free to change — of itself, or with the times. Management therefore exercises its power through leadership in executing ideas . . . not through ownership.

This is the fourteenth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

Good management can be sustained only in an environment sympathetic to its aims. It has an undeniable obligation to society, because it must be a compatible part of the social structure or be rejected by that structure as a whole.

An environment sympathetic to its aims means, also, that industry, in the very serious reconstruction period ahead, will not be at full effectiveness if it is subjected to attacks by government no matter what the underlying reasons may be — over-zealous devotion to a cause, lack of understanding or just plain politics. It was to industry — to industrial management — that the government turned when our existence as a free nation was threatened; it is to industrial management that government must turn in order to win the peace.

This statement is made in the sincere conviction that what has made America strong is industry's ability to produce consistently more and more goods and services for more and more people. It is only by actually creating them that we built up our stockpiles of the necessities of life. And it is only by creating them that we can have more of those things that make life worth while. These become available to more people as industry succeeds in getting greater output of goods and services for a given input of human energy, materials and power.

And what of the physical jobs ahead? In this country alone, there will be an immense demand upon industry to supply the things people have been unable to purchase during the war. Today the nation is wearing out not only its automobiles, refrigerators, vacuum cleaners and radios, but its very houses, its roads, railroads, and airline equipment. It is saving its money while whetting its appetite. Truly, the calls the American people will make upon industry in the postwar period will be many and insistent.

This demand can be viewed in another light. Economists say there will be 56,000,000 persons seeking gainful employment after the war. The Committee for Economic Development has estimated that $140,000,000,000 worth of goods and services will be required each year for those people. Compare that with our actual output of $97,000,000,000 worth of goods and services in 1940 when gainful employment was 46,000,000.

These future jobs will be done if industry's management is not too much hampered by government management. Management in industry performs its function in the field of *doing* things. Management in government performs its function in the field of *regulating* things. The best cooperation of the two kinds of management will be necessary in the postwar period. Certainly, too much of the regulatory kind will interfere seriously with the kind that does things.

Industrial management must improve, too. If it is too selfish, if it does not recognize definitely the trusteeship inherent in its job, if it does not understand and live up to its social responsibilities, then it will be risking all for which we are fighting. The following suggestions are made to indicate the direction that management's self-improvement can take.

Evolution in management has been too slow in some respects. Management in industry has been too prone to see the advantages in technological development while being blind to its evils. Looking at industry and social progress as a whole, there can be no doubt as to the value of technological improvement. It creates jobs. It elevates the standard of living. But that economic fact is of no satisfaction to the individual who loses his job because a new machine or a new method required one less man. By and large, this is an evil that management can do something about.

Management has been too careless of its opportunities with regard to labor. On that account the pendulum of social readjustment has swung too far. Labor has been given extensive privilege without corresponding responsibility.

Industrial management has been too slow to abandon its policy of letting the buyer beware. As a result of this, industry today is over-regulated.

Management has been too slow in recognizing its responsibility to promote the economic philosophy that a society cannot have for consumption what it does not produce. A companion educational item too long neglected is management's obligation in the field of public relations.

In these years since 1900, industrial management has been growing. Perhaps many of its experiences have been but growing pains. Management has learned, among other things, the absolutely vital need for capital at the right time and in the right amount. It has learned to use some of its earnings as "seed-money" in the introduction of new products and the use of new processes. It has learned to invest more and more in research. It has learned of the interdependence of industry and agriculture. And it has learned much about the eternal triangle of industry, labor and government.

With such a history and such experiences behind it, I have every faith that management is going ahead to even more glorious accomplishments in the winning of the war, and I believe that its peacetime accomplishments to come are beyond the prediction of any of us — even management itself.

President, McGraw-Hill Publishing Company, Inc.

What's In This Issue

Drill Out the Barrels

Greater production of gun barrels may be attained through the use of drills with carbide tips and carbide wear plates. Feeds can be twice as great as with high-speed steel drills, while runs between sharpenings can be as long as 20 hours. In an article beginning on page 83, T. R. Skofteland, manufacturing engineer, International Business Machines Corporation, describes that company's success with such drills.

LEON J. KELLER

Workers Are Available

Lack of hearing need not exclude a human being from work requiring only keen eyesight, nor the absence of a hand prevent operating a machine. Forced by manpower shortages to venture into the employment of physically handicapped workers, personnel managers are finding to their surprise that, within their limitations, they are as good or better than the fully capacitated. Leon J. Keller, training supervisor, Westinghouse Electric Elevator Company, writes of his experience in this field on page 93.

Inspection of Soft Plate

Lead-indium plating protects silver airplane motor bearings from crankcase acids, but because of extreme softness of the alloy, adds considerably to inspection difficulties. Troubled with the necessity of inspecting bearings plated with an alloy so soft that the contact pressure of gaging tips would mar it, Wright Aeronautical Corporation turned the problem over to Pratt & Whitney, Division Niles-Bement-Pond Company. The methods devised for overcoming this problem are described on page 86, especially the method of chasing and the lead accuracy that is maintained.

Precise Production

Leadscrews for toolroom lathes require a high degree of precision. To assure this accuracy, the Lodge & Shipley Machine Tool Company studied existing methods, developed a special precision lathe, and installed it with Zeiss measuring equipment in a constant-temperature room. On page 90 the method and equipment are described.

C. W. SMITH

Cleanliness Before Plating

C. W. Smith, research engineer of the Alkali Division, Detroit Rex Products Company, is the author of a series of articles dealing with "Cleaning Steps for Painting and Plating." Part 3, entitled "Processing Layouts for Metal Cleaning," which begins on page 97, discusses the chemical and physical properties to be observed in efficiently cleaning steel prior to painting or plating.

Tooling for the Stars

Aircraft fixtures are now being built from standard elements—box beams, gusset plates, clamps, brackets and other parts. Such standardization means that fixtures can be designed more rapidly and that they will have greater rigidity. The *Constellation*, giant cargo and troop carrier, is the first ship to be tooled throughout using this technique. G. A. Betts, manager, tool engineering department, Lockheed Aircraft Corporation, tells about it on page 109.

G. A. BETTS

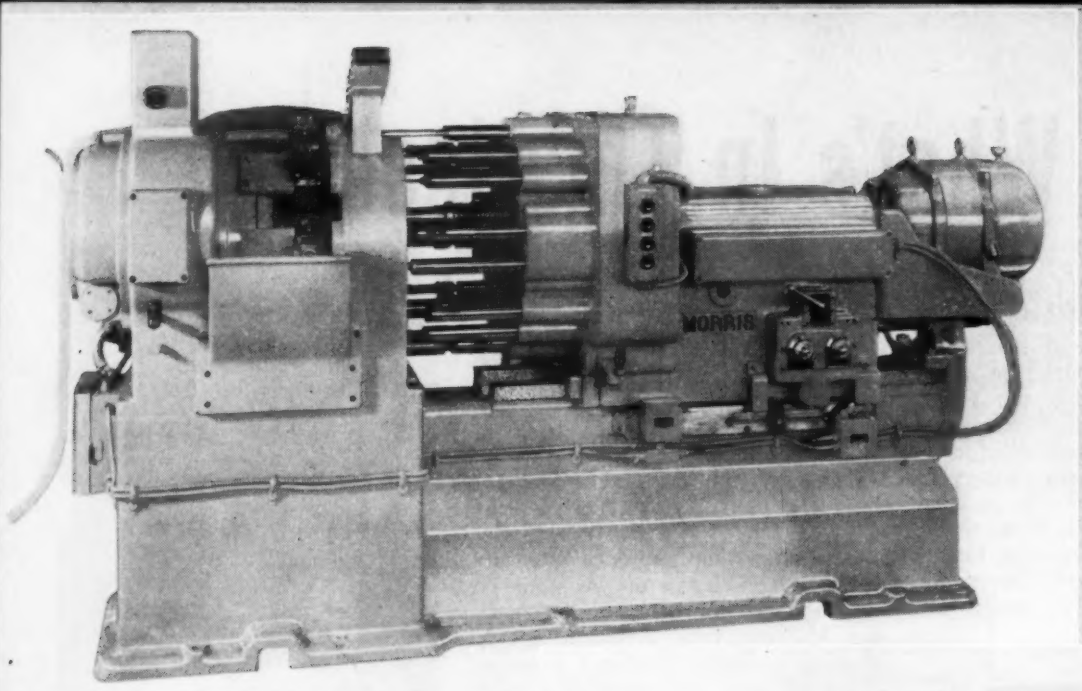
Stretches to Fit

It took a war to show production men the value of the stretch press in aircraft manufacture. But today it is being used extensively, and is available with several ram speeds, greater tonnage capacities and improved control. C. L. Fenn, chief tool engineer, Edo Aircraft Corporation, is the author of an illustrated article, commencing on page 99, describing the present diversified use of this type of equipment.

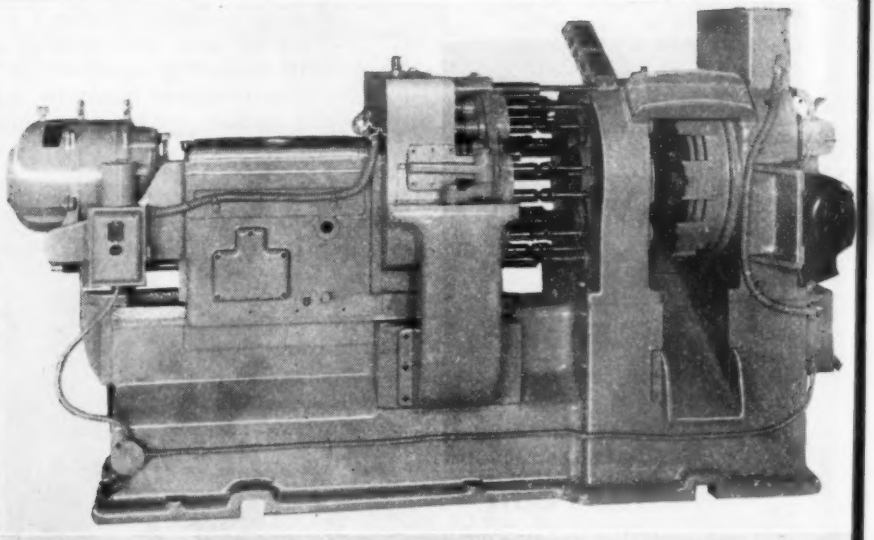
COMING

Mating the halves of the *Dauntless* dive bomber while the assembly line is in motion, and quickly changing carriage height to facilitate work, are two of Douglas Aircraft Company's innovations which have produced results. An article will appear in an early issue, describing Douglas' moving assembly line in detail.

Grinding has developed to a position among the nobility of accurate metal-working operations. Its uses are varied and its applications sufficiently simple to allow of a high degree of automaticity of operation. To aid operators in learning to handle grinders, a soon-to-be-published installment of the "Tools of Our Trade" series will be devoted to them.



MORRIS BUILDS MACHINES *to specific job requirements*

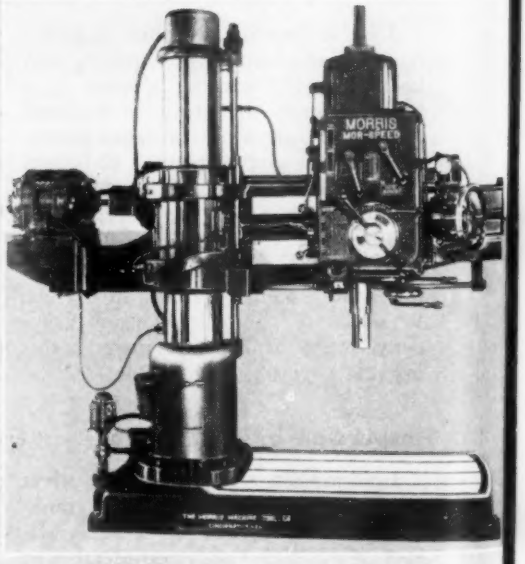


● In addition to its line of Mor-Speed Radials Morris engineers — design — and build special machines to specific job requirements.

The horizontal drilling machine shown is typical of the special equipment built by Morris to meet an individual requirement.

This machine drills—reams—counterbores and hollow mills the end of valve quide bushings. A horizontal self contained hydraulic feed unit operates the 14 spindles. Loading and unloading is accomplished automatically by gravity. Clamping and unclamping of fixtures and indexing is automatic.

If your plans call for drilling — reaming — boring — facing or similar operations consult Morris Engineers on your high production work requiring special equipment.



Morris Mor-Speed 13" column Radial, one of the Mor
Radial Drill family

Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.

CINCINNATI, OHIO

American Machinist

ESTABLISHED 1877 • BURNHAM FINNEY, EDITOR

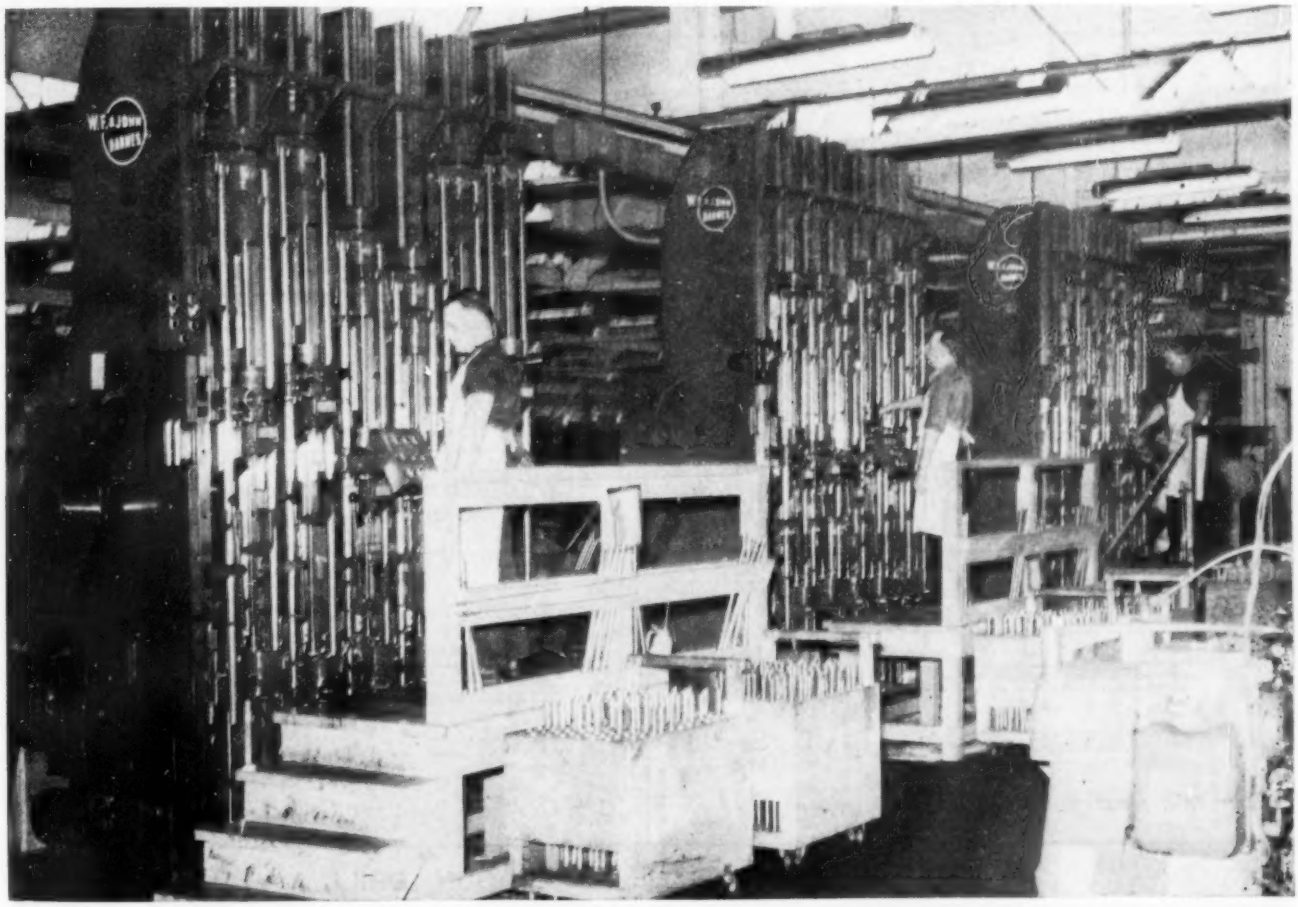
Rifle Drilling With Carbides

BY T. R. SKOFTELAND, MANUFACTURING ENGINEER,
INTERNATIONAL BUSINESS MACHINES CORPORATION

GUN DRILLS with carbide tips and carbide wear plates around the periphery of the drill will give exceptionally high production rates because of fast permissible feeds and long life between grinds. Such drills, designed and manufactured at the Poughkeepsie plant of International Business Machines, Inc., are being used for drilling gun barrels and other gun parts made from steel up to 380 Brinell hardness, and have run as long as 20 hours between grinds. Compared with high-speed steel drills, feeds have in some cases been doubled. The two carbide wear plates which back up the tip show negligible wear throughout the life of the drill, thereby maintaining its accuracy and producing smooth holes with minimum run-out.

Drills incorporate carbide tips and carbide wear strips to back up the drill. Inserts limit wear and minimize run-out. At feeds up to 2 in. per min., they run 20 hours without resharpening

Standard drills of 0.293, 0.300,

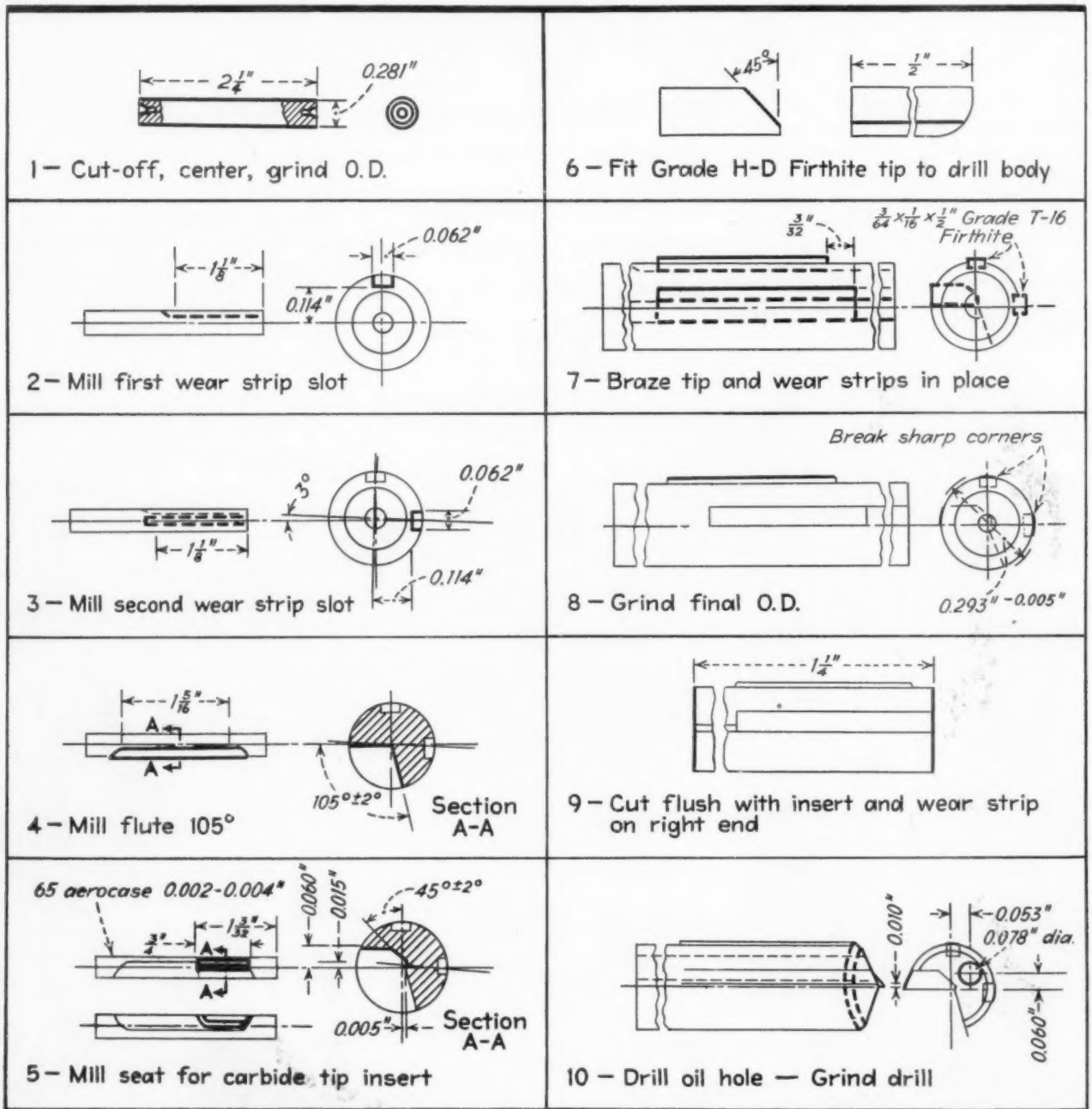


Production from these W. F. & John Barnes deep-hole drilling machines is above one 30-cal. rifle barrel every minute. The drills with carbide tips and wear strips will turn out 70 to 75 barrels between grinds

0.330, 0.494, 0.697, 0.733 and 0.781 in. diameters have been made to date, using the production sequences illustrated for the 0.293 in. size. A drill of entirely different design, but also employing the carbide tip and wear plates is used for drilling a 1.150 in. air-cylinder hole in the receiver body of a 20-mm. automatic cannon. The production sequence and design of this latter drill are shown in a second drawing.

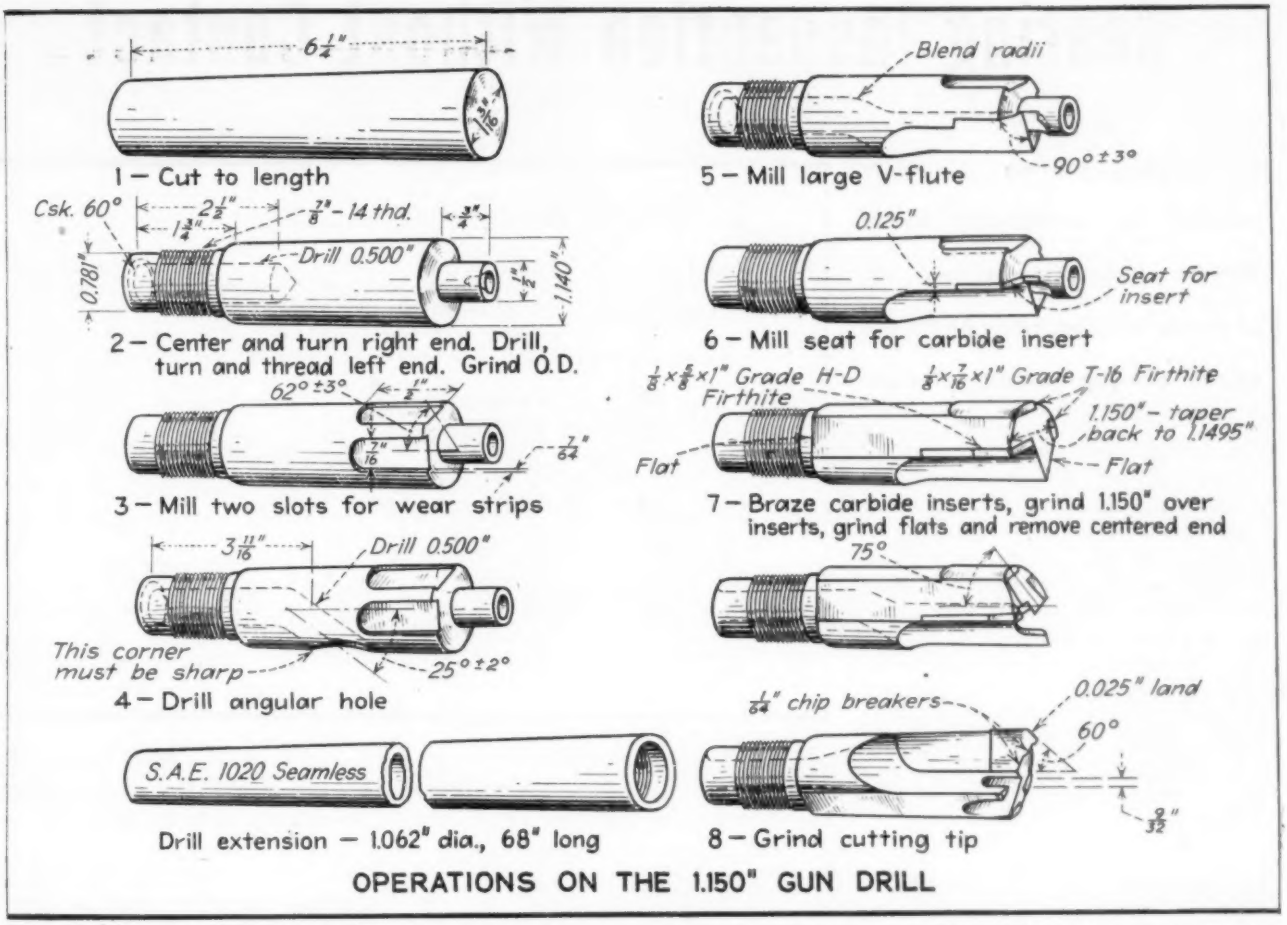
Seats for the carbide tip and wear plates are milled in the drills. Grade H-D Firthite is used for the cutting tip, while Grade T-16 Firthite is used for the wear plates. Both the tip and wear plates are brazed in the slots using Hand & Harmon's Easy-Flow No. 3. The conventional gun-drill grind is used on all sizes; however, it is important that the cutting edges be honed to a mirror finish.

The 0.293 in. drill, shown in one of the drawings, is for drilling 30-cal. rifle barrels 24 in. long. Although an average feed of 2 in. per min. is used, 2½ in. per min. has been maintained for long runs. In production, this drill has been used for 20 hours without grinding. Drilling is done in W. F. & John Barnes six-spindle vertical machines, the spindles running at 2,800 r.p.m. Each machine turns out one 30-cal. barrel every 2 to 3 min. Based on an average life of 20 hours between grinds, each drill is good for 70 to 75 barrels before resharpening. Comparable production



OPERATIONS ON THE 0.293" GUN DRILL

Seats for the carbide tip and wear strips are milled in the drills. Grade H-D Firthite is used for the cutting tip, while Grade T-16 Firthite form the wear strips. The conventional gun-drill grind is used on all drill sizes



This single-lipped drill with Firthite tip and Firthite wear strips is used to run a 1.150 in. hole in the receiver body of a 20-mm. cannon. At 600 r.p.m., feed is 1 in. per min. It runs 10 hours between grinds.

has been attained with drills of other sizes.

The manufacturing sequence on all the drills is somewhat similar. That for the 0.594 in. drill is as follows:

1. The stock is cut-off, centered, and ground to 0.578 in. diameter.

2. Grooves for the wear plates, the chip flute, and the seat for the carbide tip are milled.

3. The wear plates and carbide tip are brazed in place.

4. The stock is ground on centers to the correct diameter over the carbide inserts, leaving the body slightly undersize, in this case, 0.578 in. The latter eliminates the need of relief or back-off on the drill.

5. Both centered ends are cut-off and the oil hole is drilled.

6. The drill tip is butt-welded to the conventional fluted-type seamless-tube shank.

7. Finally the drill is sharpened.

This drill, as well as the other sizes, may be made from drill rod; however, better results are obtained with SAE 3115 steel Aerocase hardened to a depth of 0.003-0.005 in. before brazing in the wear plates and tip. Case hardening minimizes the danger of picking up chips and slight tears on the soft core of the barrel when drilling. The 0.578 in. diameter drill will run up to 20 hours without sharpening, and will take a feed of 1½ in. with ease.

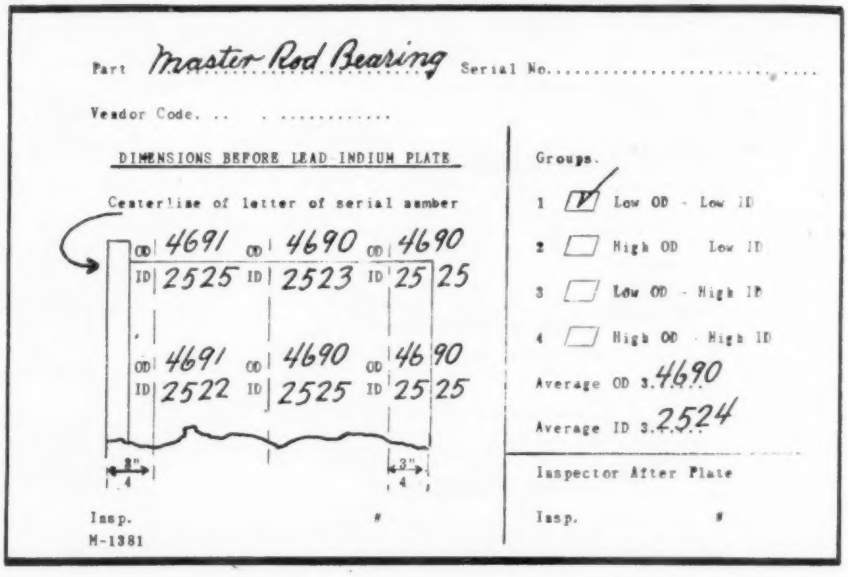
The machine used for drilling the 1.150 in. air-cylinder hole in the receiver body of 20-mm. automatic cannon was originally built for a two-lipped drill with the chip return through the center of the drill extension. Chips would often plug this center hole, causing the stock to run-out as much as 0.030 in. in 24 in. This condition was overcome completely by the 1.150 in. drill shown in the drawing. The double lip was replaced by a single lip tipped with carbide and backed up with two carbide wear plates. Since this drill was designed, run-out in the receiver body has been held consistently within 0.008 in. in 24 in. Chip breakers, ground as steps on the cutting edge, split the chips while drilling and reduce the possibility of the plugging. The success of this drill is partly due, of course, to the rigidity of the round extension tube compared with the conventional fluted seamless tube used on small drills. Another asset is the ease of removing the drill by simply unscrewing it from the extension tube.

The 1.150 in. drill is used in a No. 420 W. F. & John Barnes horizontal drilling machine while running at a speed of 600 r.p.m. The speed should be higher, but due to the heavy cradle used for holding the work it is not essential. At the 600 r.p.m. speed, the drill feed is ⅞ to 1 in. per min., under which conditions the drill can be used for 10 hours and more without resharpening. A feed of 1¼ in. per min. can be used at higher speeds. The tailstock of the machine is so constructed as to let the oil, under pressure, enter along the drill extension which is ⅛ in. smaller in diameter than the drill. The oil flows along the two outside flats on the drill up to the point, and finally back through the flute and hole in the extension tube, carrying the chips with it.

Bearing Inspection Without Contact

Lead-indium plating is easily marred or scratched; hence Wright checks the critical I.D. of master-rod bearings by means of the air-gap gaging principle

REPLACEABLE PRECISION BEARINGS for master rods of Wright engines are plated with approximately 0.001 in. of lead-indium alloy to protect the actual bearing metal—silver—from corrosive attack by crankcase acids. This extra step to insure trouble-free service posed an unusual inspection problem. The lead-indium alloy is so soft that it is easily marred or scratched by contact pressure or sliding action of gaging tips. An indication of the problem lies in the fact that one's finger rubbed over the lead-indium surface will leave burnish marks.


Part Master Rod Bearing Serial No.
Vendor Code.
DIMENSIONS BEFORE LEAD INDIUM PLATE
Centerline of letter of serial number
OD 4691 OD 4690 OD 4690
ID 2525 ID 2523 ID 25 25
OD 4691 OD 4690 OD 4690
ID 2522 ID 2525 ID 25 25
Groups.
1 Low OD - Low ID
2 High OD - Low ID
3 Low OD - High ID
4 High OD - High ID
Average OD 3.4690
Average ID 3.2524
Inspector After Plate
Insp.
Insp.
M-1381

An inspection record card is written up for each bearing. After making the twelve inspections required, and averaging the results, the plating classification for the bearing is checked by the Air-O-Limit operator

Inspection procedure for the silver-plated bearing is as follows:

1. The O.D. is checked at three points along the bearing, in two planes 90 deg. apart, or six points in all, using an Electrolimit gage.

2. These figures are written upon an inspection-record card along with the serial number of the bearing. The average O.D., computed from these readings, is written in the space provided at the right of the card.

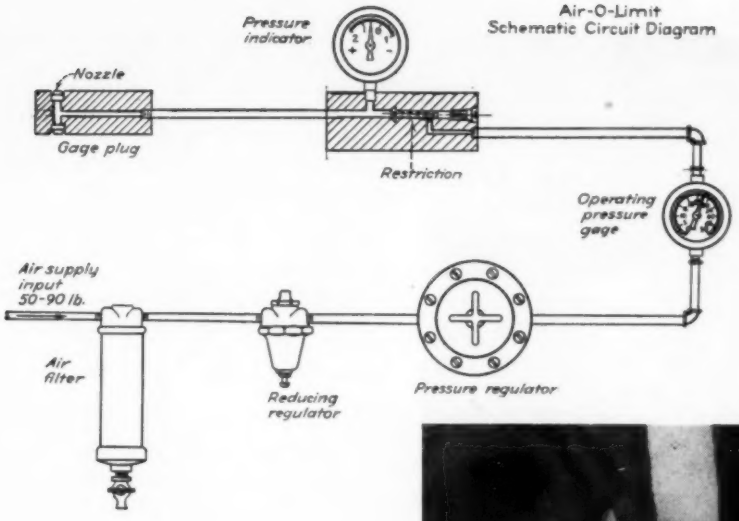
3. Six similar readings for the I.D. are made on the Air-O-Limit gage. The bearing is positioned with the serial number adjacent to a reference mark on the work anvil. Three successive readings are taken in each position of the bearing—at a depth of ¾ in. (beyond the tapered end relief), at the center, and again at ¾ in. from the further end. Appropriate carriage positions for these readings are established by a pointer moving over a scale fitted to the bed. The second set of three readings is obtained by rotating the bearing 90 deg.

4. The I.D. readings are averaged, and the result is written in the space provided at the right hand side of the card. These average figures for O.D. and I.D. provide the basis for placing the bearing in one of four classifications whereby the bearing will be lead-indium plated to the desired final dimension. These classifications are: (1) Low O.D.—low I.D., (2) High O.D.—low I.D., (3) Low O.D.—high I.D., and (4) High O.D.—high I.D.

5. A duplicate inspection record card is made out and inserted in the silver-plated bearing before its transfer to the plating department. The original card is filed.

The nature of the bearing adds to inspection difficulties. One end has a splined locking flange that does not distort, but the plain end is prone to go out of round. Each end is also relieved about 0.00025-0.00045 in. for a distance of 0.400 in. It is therefore necessary to take readings at three points along the bearing, both I.D. and O.D., in two planes, or twelve points in all. These are made on the "as received" silver-plated bearing to see that: (1) out-of-roundness does not exceed 0.001 in., (2) the diameter lies within a total limit of 0.0005 in. and (3) to establish the weight of lead and indium to be deposited so that the final diameter does not exceed assembly standards. After lead-indium plating, the bearing is checked once more to insure bearings that meet this requirement.

The first method of inspecting the lead-indium plated dimensions relied upon inside micrometers to check the I.D., and Electrolimit comparators to inspect the O.D. For gaging the I.D. of lead-indium plated bearings, girls achieved a production rate of approximately four bearings per hour because of the care required to avoid scratches. The difficulty of training operators to the proper "feel," the lack of uniformity in gaging results between operators, the slowness of the operation, and the desirability for inspecting



To control the flow of air from the two nozzles, or orifices, the shop air pressure is reduced by two regulators and line fluctuations are ironed out by a restriction tube in the gaging spindle

the lead-indium plated I.D. without contacting the surface caused Wright to turn the problem over to Pratt & Whitney, Division Niles-Bement-Pond Company for solution.

While application of the Air-O-Limit principle to this particular problem was going forward, P. & W. engineers supplied a No. 3A Electrolimit internal hand gage with specially lapped contact points and greatly reduced measuring pressure. This gage worked satisfactorily for checking the silver-plated "as received" bearings.

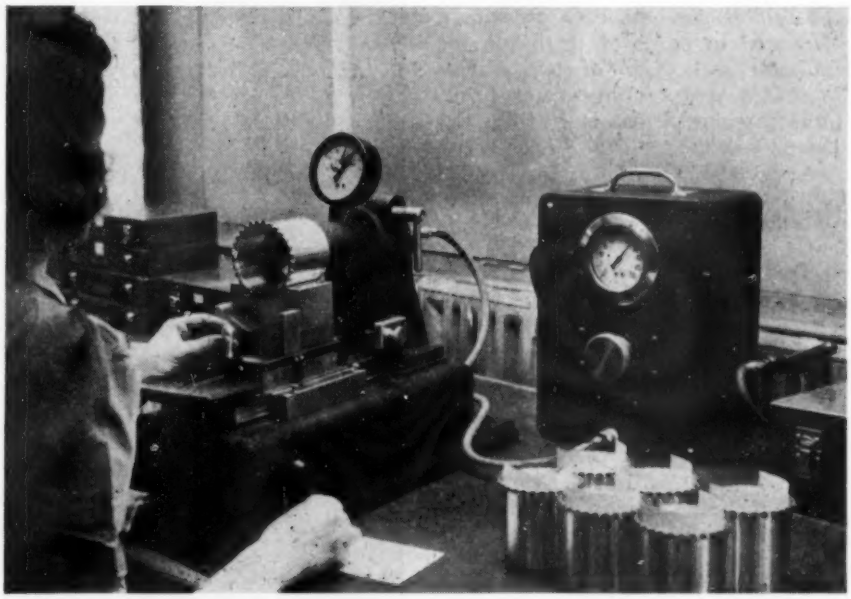
The Air-O-Limit gage is now used to check the I.D. of both the silver-plated bearings and the indium-lead-plated bearings, and it has been found that only one gaging spindle need be employed to check a bearing of a given size before and after lead-indium plating. This is true because the scale is of sufficient range to cope with a difference of 0.001 in.

How the Air-O-Limit Works

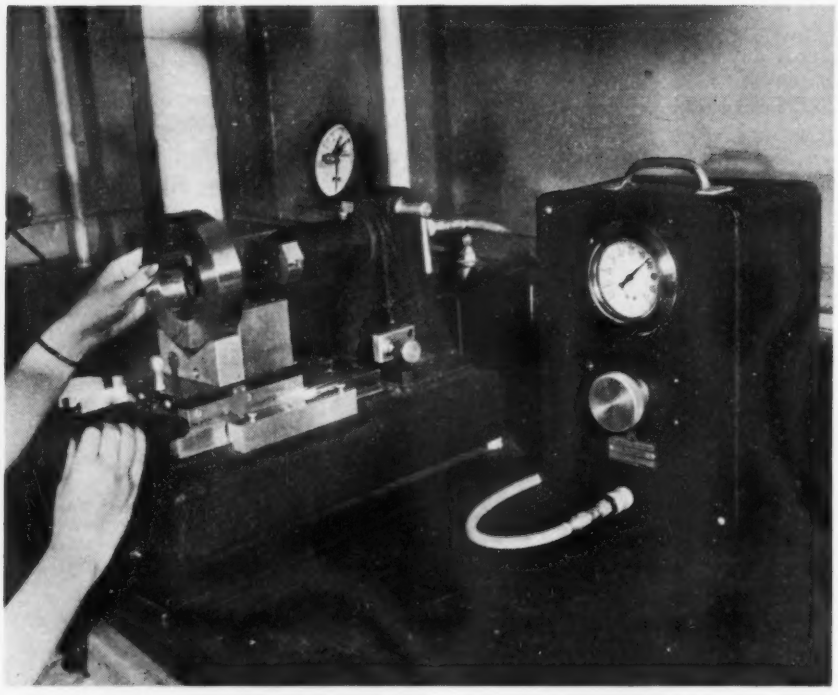
Two main pieces of apparatus comprise the Air-O-Limit gage. The air-control cabinet contains a filter unit for removing moisture and foreign matter from air taken from the shop line. The air passes from the filter to the first pressure-reducing valve where it is stepped down to 50 lb. per sq. in., and next to a second, adjustable pressure valve for a further reduction to 30-35 lb. per sq. in. for operating the gaging spindle. This valve contains a mechanical adjustment means for accurate zero setting of the gage indicator. The low pressure realized by the adjustable pressure-reducing valve is read on a meter in the face of the air-control cabinet.

Compressed air from the air-control cabinet is fed into the rear of the gaging spindle, which is clamped to

An Electrolimit gage is employed to check the O. D. of the bearing shell for the master rod, both in the silver-plated "as received" condition and after lead-indium plating



To avoid scratching or marring the I. D. of the bearing, particularly after lead-indium plating, an Air-O-Limit was developed. Use of the air-gap gaging principle is at least five times faster than inside micrometers



Tolerance markers on the Air-O-Limit gage are set by mounting a master ring gage on the front V-block and traversing the carriage until the "not go" or the "go" gage surrounds the two-orifice gaging plug

the column of the gaging apparatus proper. Here the air passes through a restriction tube which serves to prevent pressure fluctuations, and thence to two orifices placed on opposite sides of the gage plug. The clearance between each orifice and the adjacent bearing wall is 0.003 in. to avoid any possibility of contacting the work and marring it. The air gap so created restricts free flow of air from the orifices, and the back pressure is calibrated in terms of tenths on the indicator dial. Use of two orifices permits a spot reading at any plane, and consequently out of roundness is detected by rotating the bearing, and taper by traversing the gaging spindle.

Method of Setting the Air-O-Limit

Two anvils of the V-block type are mounted on the work carriage. This carriage travels on balls and slips the bearing over the stationary gaging spindle without contact. The front anvil is permanently mounted, receives master ring gages used for setting up gaging spindles for bearings of different diameter. All master ring gages are of the same external diameter, and the internal diameter is made concentric with the O.D. to close limits.

To make a set-up, the work anvil is exchanged by removing four socket capscrews, and mounting the new anvil on a tongue in the base of the carriage. The gaging spindle is held in the column by a clamp screw and is quickly exchanged. Several spindles may be used with the gage, according to undersize, standard and oversize bearings made in production for original equipment and service master rods. The particular gage illustrated can receive gaging spindles to inspect diameters from 2 to 5 in. in diameter, but a smaller prototype will handle bores as small as ½ in.

The plating department segregates the bearings according to the classification, and plates them on the O.D. and I.D. for standardized times worked out for low O.D., high O.D., low I.D., and high I.D. In other words, a standardized plating current is employed, and the weight of lead or indium deposited then becomes a function of time only. The plating operator is supplied with charts which give the weights in grams plotted against minutes. Once every eight hours a bearing is weighed before and after plating and the plating rate is computed. If the rate of deposit is outside of established limits the set-up and solution are checked.

Careful cleaning of the silver-plated bearing shell is carried out prior to lead-indium plating. The cleaning cycle consists of: (1) solvent degreasing in a tank, (2) hang in soap solution for 10 min., (3) hot and cold rinses, (4) electric cleaner dip for 15 sec., (5) hot and cold rinses, and (6) brush the splined locking flange to remove any trace of dirt.

For plating the cleaned bearings, two pieces are stacked vertically, plain end to plain end, in a fixture. This arrangement provides uniform thickness of plate along the bearing, over-

Two bearings are stacked in a fixture for lead plating to avoid uneven plate thickness, particularly a thicker deposit at the ends

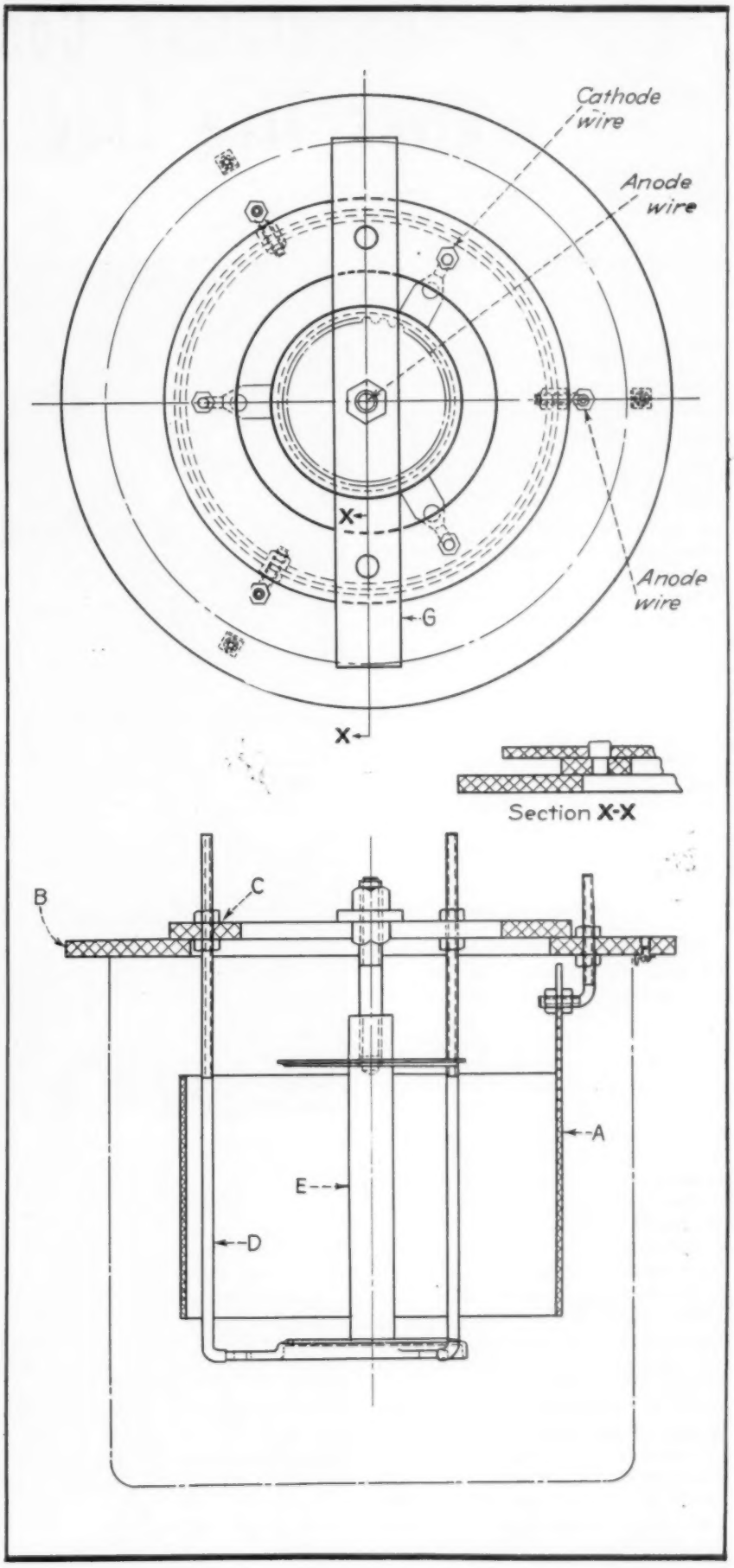
comes the tendency for the plate to be thicker at the ends of the piece as was the case when a single bearing was plated in the fixture.

The cathode wire is connected to the plating rack. Two anode connections are provided. One is connected to the cylindrical anode placed centrally inside the stacked bearings. The other lead is connected to the shell-like anode surrounding the plating rack. Thus, either circuit can be broken when the standardized cycle time has been realized for either the I.D. or the O.D., and current is left on the other circuit until that cycle is also finished. For lead plating, the anodes are lead, and a fluoroborate lead solution is used. For indium plating, the central anode is sheathed with platinum, and the exterior anode is a platinum shell. The plating material in this case is an indium, dextrose, cyanide solution commonly employed in indium plating operations.

When the piece has been lead plated, it is washed and put on a second plating rack for the indium-plating operation, to prevent carryover of chemicals from one bath to another.

Diffusion of Indium

The bearing is next washed and dried, then placed for 2 hours in a hot oil bath maintained at 340 F. to diffuse the indium throughout the lead. After cooling, the bearing is degreased and returned to inspection for checking the diameters, the plating department's copy of the "as received" inspection being filed. The procedure here is exactly the same as exercised in checking the silver-plated bearing shell. The Electrolimit gage is employed for checking the lead-indium plated O.D., and the Air-O-Limit gage is used to inspect the I.D. A slip of paper having the average I.D. and O.D. is put into the lead-indium plated bearing before it is sent to stores. Experience indicates that the application of the air-gap gaging principle to avoid scratches can give an inspection rate five times faster than the use of inside micrometers.



Convenience is the principal feature of the plating tank and fixture. Anode A for plating the O.D. of the bearing is fixed to the stationary Celeron ring B. The plating fixture assembly, consisting of the insulator C, and the three-legged basket D, is dropped into B. Then the anode E for plating the I.D. of the bearings is put in place with support G

Temperature Control Gives True Leadscrews

BY FRED SCHOEFFLER
WORKS MANAGER
LODGE & SHIPLEY
MACHINE TOOL COMPANY

TODAY'S HIGH DEGREE OF PRECISION in machine tool building has come about largely through the application of scientific methods to manufacture and inspection. This is particularly true of the leadscrews required for toolroom lathes, where the ultimate in precision is desired.

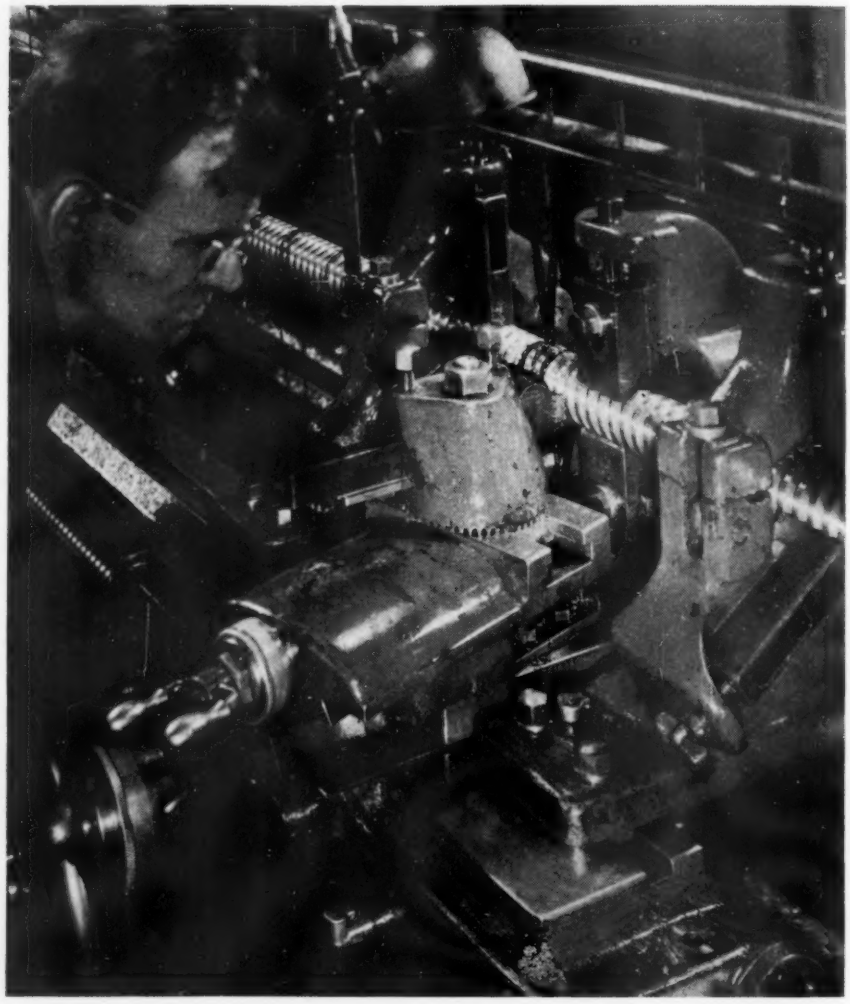
For years the chasing of leadscrews has been performed on lathes modified or designed for the purpose. The growth in precision toolroom work and the increasing demand for still more accurate leadscrews caused the Lodge & Shipley Machine Tool Company to study existing methods of manufacture and inspection. The outcome was the development of a special precision lathe, which is installed with Zeiss measuring equipment in a constant-temperature room.

Heat Affects Accuracy

The influence of temperature change on work and machine is of particular importance when chasing accurate leadscrews. The temperature of the room, the lathe, the cutting lubricant and the work must all be carefully controlled. Otherwise, when chasing a leadscrew to limits of 0.0004 in. per ft., the time for the chasing tool to pass from one end of the screw to the other is long enough for a change in temperature of one of these four elements to affect the accuracy of the finished product.

Recommendations of air-conditioning engineers were sought for construction of the constant-temperature room. Walls of the room are heavily insulated, it is air conditioned, and the temperature is thermostatically controlled within close limits.

As an additional check, two thermometers graduated to ½ deg. F. are mounted on the machine. One thermometer is placed on the master leadscrew in the precision chasing lathe, and it is insulated so that room temperature does not affect the reading.



For finish chasing precision leadscrews, the temperature of the room, the lathe, the cutting fluid and the work must be carefully controlled. Likewise, it is important to support the work close to the cutting tool

The second thermometer is placed in the coolant stream.

To avoid temperature rise of the cutting oil during machining, a special refrigerating unit is connected to the coolant reservoir to dissipate heat generated by the chasing operation.

To maintain uniform temperature of the headstock spindle and workpiece, coolant is pumped through the hollow headstock spindle and through a long delivery pipe with outlets at frequent intervals over the work.

The special precision lathe differs from the usual toolroom type in several respects, and incorporates features essential to production of accurate leadscrews in diameters up to 3½ in. Power is supplied to the headstock by a multiple V-belt drive at the rear of the lathe. The selective-type headstock incorporates a large spindle with a 3½-in. hole and a special collet chuck.

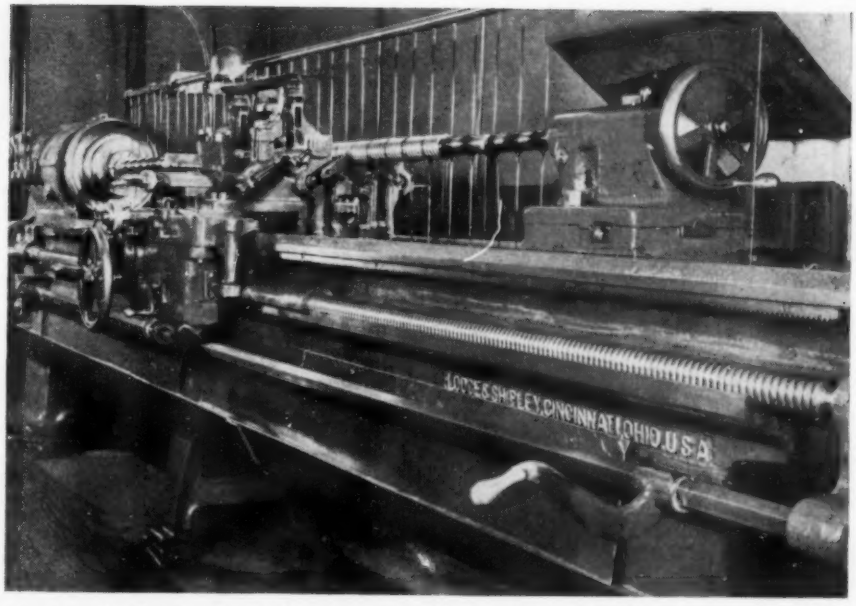
A wide range of leads is obtained by driving the master leadscrew direct from the rear of the spindle through simplified gearing. An uninterrupted half bearing cast integral with the bed

supports the master leadscrew for the full effective length of thread. End thrust is taken on extra large plain thrust bearings.

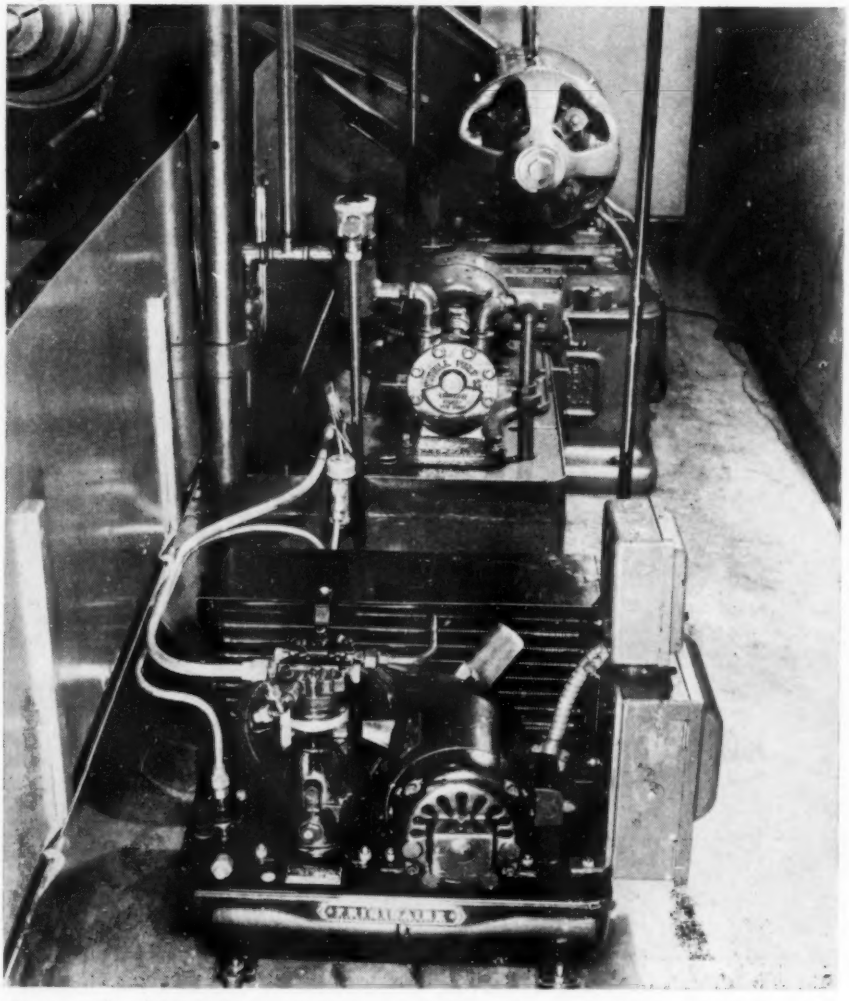
The simplified apron includes a special long half nut and the handwheel and reduction gears for hand traverse along the bed. Carriage and compound rest are of conventional design. Three follower rests are mounted on the wings and the bridge of the carriage.

At present, Lodge & Shipley has three master leadscrews, which have been generated over a period of years by constantly striving for greater accuracy. One of these leadscrews is installed in the machine, the other two of equal accuracy are carefully stored in widely separated parts of the plant. Lead accuracy of the screws is 0.0003 in. per ft. of length, measured at random, and the accumulative lead error is only 0.0007 in. in a thread length of 13 ft.

In this leadscrew lathe, finish chasing is done with one "gooseneck" spring-type tool made of high-carbon steel, since a keen edge must be maintained for accurate chasing of long screws. The tool is ground in accurate relation to the front side and bottom of the shank in order to facilitate accurate setting of the tool in the holder. Usually, finish chasing is done at about 25 ft. per min. with the last three or four cuts being made with less than 0.001 in. depth of cut, the chip produced being a lacy ribbon. After finish chasing, a tool with a 45-deg. angle on each side is used to break the sharp edges at the top of the thread. No further finishing is required of these leadscrews.



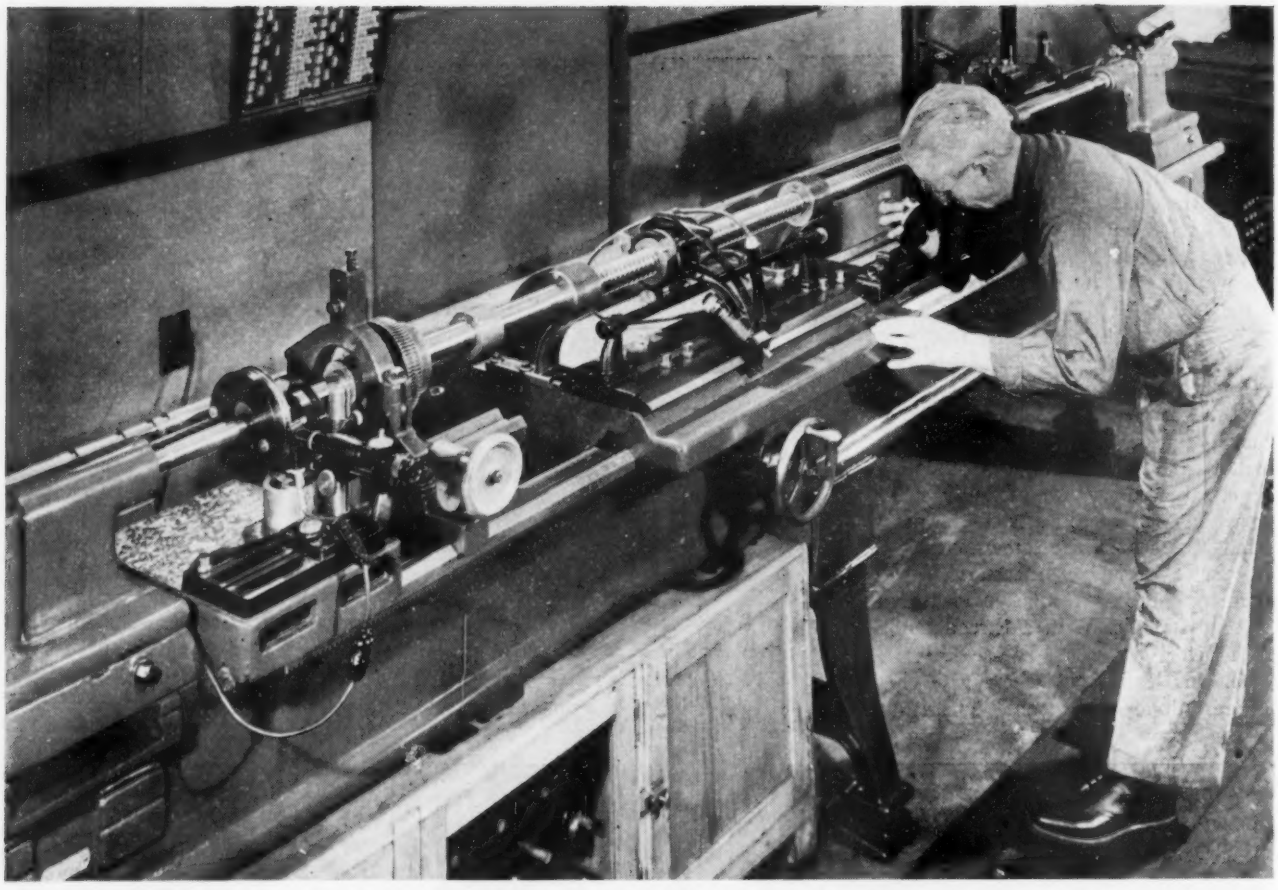
Lodge & Shipley built this special finishing lathe for final operations on precision leadscrews. It has a half bearing cast integral with the bed to support the master leadscrew for the full effective length of the thread. The lathe is mounted on adjustable alignment blocks



A special refrigerating unit is connected to the coolant reservoir to maintain the coolant at constant temperature

The checking of these leadscrews in the Zeiss leadscrew testing instrument involves the determination of the lead error and the periodic, or so-called "drunkenness," error. For this inspection, the leadscrew is supported in brackets integral with the instrument table and in steadyrests beyond the table. The leadscrew is rotated during measurement by means of a handwheel and worm and wheel fixed to the leadscrew. The exact amount of rotation is determined by a Zeiss optical dividing instrument at the extreme left-hand end of the leadscrew. Axial location of the screw is controlled by means of balls inserted in the center holes in each end of the leadscrew. These balls contact flats ground on the faces of the centers in the tailstocks.

The instrument table incorporates a 20-in. scale graduated in inches and

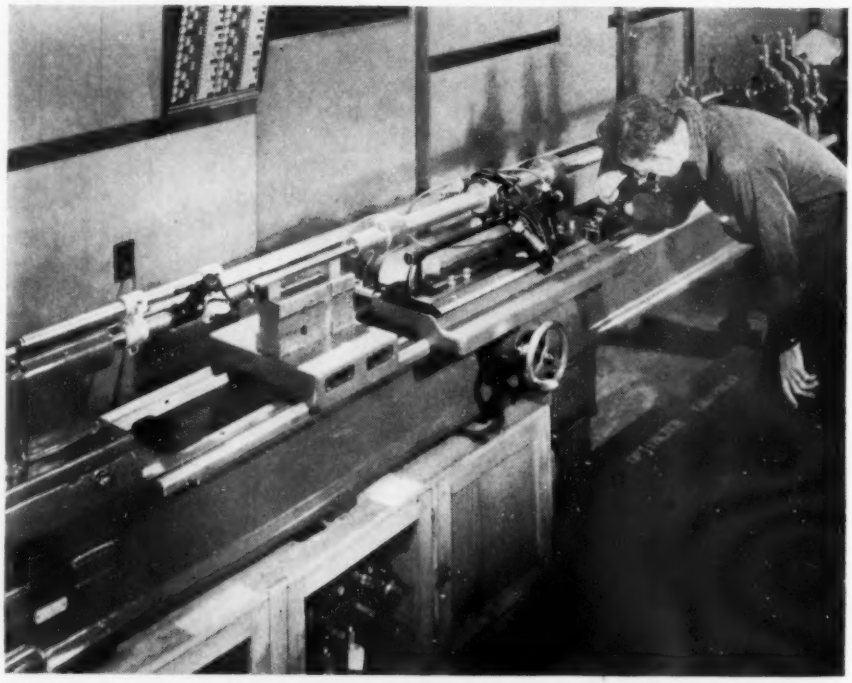


Precision leadscrews are inspected for lead errors and periodic errors with this special Zeiss leadscrew checking instrument. Amount of rotation is determined by the optical dividing instrument at the left while the movement of the traveling carrier and nut is measured by reading a scale through the optical instrument at the right-hand end of the table. Axial location of the leadscrew is controlled by balls inserted in the center holes

millimeters. This scale is mounted between two brackets and is protected by a slotted steel tube. The traveling carrier and nut moves longitudinally during rotation of the leadscrew, and the scale is read by an optical instrument on the right-hand side of the table.

Like all precision instruments, frequent checks are necessary to insure continued accuracy of readings. Since it is impractical to return the instrument to the manufacturer for periodic checking, a special set-up was developed and approved by Zeiss engineers. This set-up, when used in conjunction with a set of master Johansson gage blocks ranging up to 20-in. in length, permits checking the accuracy of the scale and the accuracy of the optical instruments used in reading the scale.

The attention to detail in every phase of operation and control to produce and maintain consistent accuracy in the manufacture of precision leadscrews is borne out in the saying "Trifles make perfection, and perfection is no trifle." This is the watchword of the leadscrew department.



Precision gage blocks are employed for periodically checking the accuracy of the Zeiss leadscrew testing instruments. All tools used for these checks of leadscrew accuracy are kept in the controlled temperature room

Their Handicaps Don't Interfere

BY LEON J. KELLER, TRAINING SUPERVISOR, WESTINGHOUSE ELECTRIC ELEVATOR COMPANY

It has taken a war and a manpower shortage to convince industry of the value of hiring handicapped workers; they find some of them better than normal personnel for certain jobs

To see this drill press operator at work one would never realize that he is a deaf mute. He loses a lot less time during operations than do normal workers, who are more easily distracted

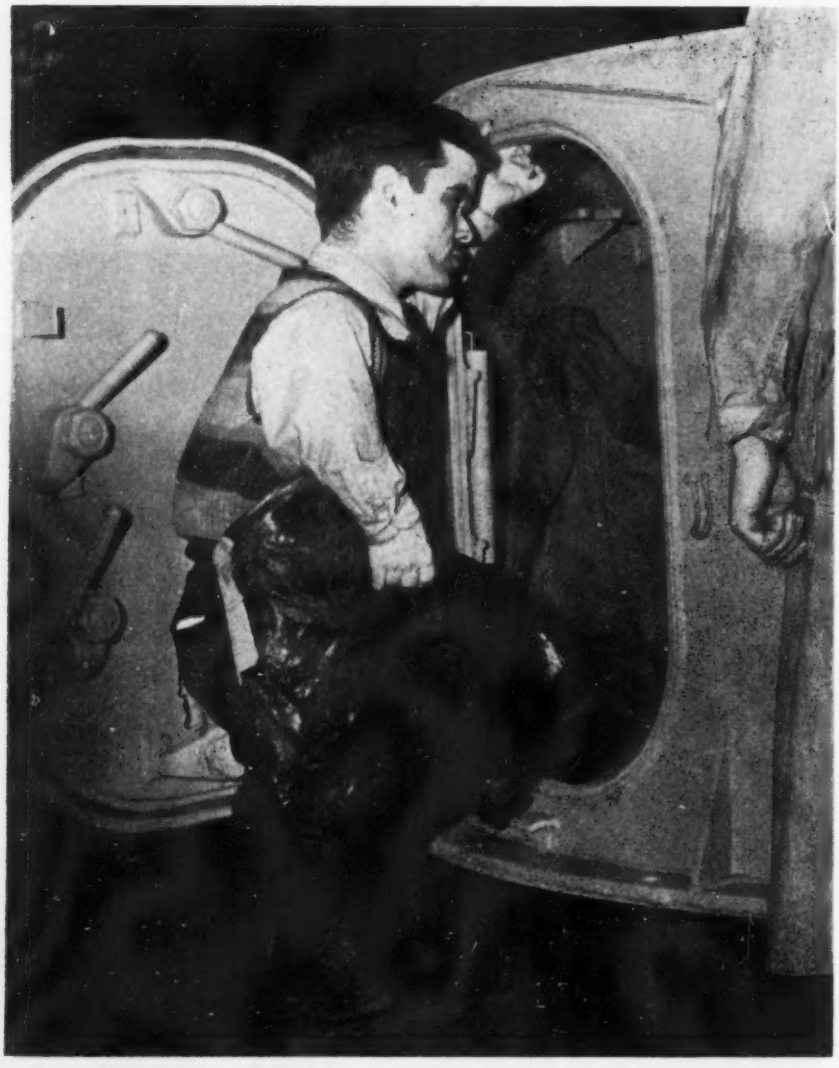
IT HAS BEEN ESTIMATED by the War Manpower Commission that approximately 25,000,000 man years of work will be required to meet the schedules of production set up by our government. In terms of workers, it will mean that approximately 17,000,000 men and women will be required to complete our 1943 schedule. Part of this 17,000,000 will be taken from the vast reservoir of the physically handicapped men and women normally considered unfit for industrial employment. The number of these handicapped people varies in the eyes of different authorities. I am inclined to accept the figure of 4,000,000 handicapped men and women as given out by the War Manpower Commission.

The reservoir of skilled workers has already been drained. Today labor shortages are growing more acute, therefore the employment of the handicapped workers is increasing every day. Generally we do not like to admit it, but a great many of our soldiers, sailors, and marines have been returned to civilian life because of battle injuries.

In the past there have been many reasons that have kept the physically handicapped out of industry and a few of these still remain today, even when manpower is scarce.

Naturally, the handicapped lack training, but in view of the fact that the skilled market is already dry, the normal people that we are hiring also lack training. The New Jersey Rehabilitation Commission under the guidance of John J. Toohey, Jr., is doing an excellent job in training these handicapped workers. These workers are carefully studied by the Rehabilitation Commission, and then placed by them for training in the job best suited to their handicap in the various Defense Training Schools, the same schools that are being used to train the normal persons. The annual report of the New Jersey Rehabilitation Commission contains a great many letters from various manufacturers telling of how well the handicapped workers that had been placed with them are doing. Our own experience at Westinghouse Electric Elevator Company with these people, has proven they are as efficient as physically normal people. They are readily accepted by other workers.

In regard to accidents and tardiness our experience shows that handicapped persons are, by the very reason of their handicap, more careful and take fewer chances than normal persons. Also we have found that physical handicaps reduce absenteeism. We know that these people usually take good care of their health. One thing we note particularly is that we haven't had any cases of after pay-day "hangovers." We also note that they are usually first to work, stay more at their bench and are the last to leave. This naturally is due to their handicap causing them to shun crowds. Certain handicaps are definitely an asset in doing more and better work. Handicaps of this nature are seen in deaf-mutes, midgets, and



This man, who stands a little over 3 ft. tall, was hired to work in spaces too small for normal persons. The assembly foreman reports "handicapped workers are as good or better than physically normal workers"

people with bad leg crippling cases.

To quote from the Annual Report of the Rehabilitation Commission of New Jersey, "Given a sound mind and ordinary, reasonable or outstanding intelligence, it may be positively stated that there is no trade or profession in which an able-bodied person may engage that could not be carried on by a handicapped person restricted only by the disability limitations."

There is a vast reservoir of manpower in the hundreds of thousands of physically handicapped workers. They are intelligent and well-educated, and although they have not been trained for specific war jobs, they frequently have self-taught skills, and more productive hobbies than the physically normal worker. These skills give them special aptitudes that make their job training fairly simple. Various industries recognize that the above facts are true and have been hiring the handicapped workers very rapidly.

Our company, for example, has 140 physically handicapped workers. This represents about 8 percent of our factory payroll. A goodly portion of these have serious handicaps.

There are many other companies already hiring many physically handicapped workers. The Ford Motor Company is probably the outstanding private employer of physically handicapped persons. Ford has been hiring these people for over ten years. Today, 11,163 disabled persons are full-time employees at the River Rouge plant.

There have been some articles published from time to time as to what other manufacturers are doing. From *Business Week*, December 5, 1942, "Announcement by Consolidated Aircraft Company, San Diego, that it would hire workers over 65, and 'all individuals regardless of physical handicap,' who could be employed safely, has brought a flood of applications.

"Given light work, Consolidated has been hiring 1,100 workers a week, 300 of whom have been over 65—half of them women. They are put to work in what the company describes as 'moderately exhausting work,' such as line-bench assembly and electric wiring installation. Isolated compartments are being provided for blind employees."

From *Business Week*, December 5, 1942, "North American Aviation Corporation now has 200 seriously handicapped employees working at its Inglewood, Calif., plant, and hundreds more with minor handicaps are on assembly lines. A half-dozen deaf mutes are in the paint shop, directed by sign language. Handicapped workers are proving so efficient that North American plans an extensive drive to enlist more of them."

From the *Herald Tribune*, December 10, 1942, "Seven deaf mutes, employed in the welding and painting departments of Curtiss-Wright Corporation, Airplane Division, make up a team in a company basketball league."

Handicapped persons can do a great deal with a little help. Handicapped workers are neither more nor less intelligent than normal human beings. The fact is that the better educated ones are available for production works. Generally they are not used in normal peacetimes.

From *New York World-Telegram*, December 10, 1942: "It was back in 1920 that Dave Bernstein had the accident that cost him his right hand, at the wrist. He was only a kid of 15 and the world seemed pretty black to him. Now look at David B. Bernstein, 37, placement director of the Federation of Crippled and Disabled, 1931 Broadway, New York, N. Y., cheerful, hardworking, married and the father of three children, he only recently completed a course at the Aviation Trades Center School. It is not enough just to help other people, he said, he wants to 'do my share in the war effort.' How well he will do that share can be seen from the fact that he is the first person in this area able to overcome his handcap and complete a course in riveting and assembly work. Bernstein can operate a drill press, electric and air drills, various type riveters and assembly jigs. His courses were mapped by the War Industries Training Program Division of the Board of Education."

Here are excerpts from several letters from the supervisors of our plant regarding handicapped employees:

Case 1. Wooden Leg and Missing Fingertips

"This individual has a wooden leg and the ends of three fingers chopped off; yet he does fine work burring. His hands are chubby and his fingers comparatively short, yet he can manipulate a knife well when filing the ends of the teeth on both spur and bevel gears.

"He has steady nerves which are necessary, when you consider that he is filing, grinding, and buffing precision gears which must be held to 0.001 tolerance runout.

"Due to his handicap, he might feel that he must do better than average. That is the peculiar part, being handicapped, he produces more and better quality than others having all their members."

Case 2. Poliomyelitis Right Leg

"This man has been working in section S3-04 for a period of five months. The job to which he was assigned involved the assembly fitting and running in of mechanical units, such as gear trains, bearing fits, and similar mechanism. In this work he was found to be a rapid learner and a conscientious and dependable worker. He was just recently appointed sub-group leader in the same section."

Case 3. Dwarf

"We have a dwarf that we originally hired because the equipment that we are building is so compact that a normal person would be unable to get inside to do some of the necessary assembling. However, this job was not ready when the worker reported for work so we put him on bench work on small assembling. He has done so well at this work that we are undecided as to whether we will take him away to do the job that he was originally hired for. Due to his handicap he is on the job ahead of everyone else in the morning and does not leave till the rest of the workers clear the floor. He gives us a full eight-hours work. I can safely say that the handicapped workers who work in my department are as good or a little better than the physically normal workers we have."

Case 4. Bent Left Leg

"While playing football he injured his knee. He has some type of bone infection, which doctors cannot cure. At the present time he cannot straighten out his leg. He can scarcely walk because, due to the bone condition of one leg, he sways from side to side when walking. He is always first to his bench in the morning, and last to leave at night. He stays consistently at his work the entire day. He is extra cautious when leaving the building in order that he will not injure himself. He has a nice personality and is accepted by the group as one of the boys."

Case 5. Polio Arm

"Partially paralyzed in one arm and slightly so in one leg, this man is a graduate of the Newark College of Engineering and an exceptionally good worker. He has but little use of one arm yet can do almost anything a normal person can do. He is exceptionally thorough."

Case 6. Stiff Elbow

"Another worker has been classified 4-F because his arms are so crippled that he cannot keep them straight down or out. They must always be at a curved angle from the elbow. This condition is due to an accident while very young.

"I have him now working where the working surface plate is high enough for him to inspect manufactured parts within the radius that he can move his arms. He is quick to catch on to the inspection procedure, and what is more, he can do anything that an able-bodied inspector can do except stand at attention like a soldier or lift anything heavy."

Case 7. Defective Vocal Chords

"A worker with a defect in his vocal chords, caused by diphtheria in his childhood, cannot speak above a hoarse whisper.

"When this man was interviewed for employment, some reluctance was felt due to this defect. However, a 4-F draft classification was not to be sneezed at.

"After close to one year of service,

A poliomyelitis leg does not hinder this worker's usefulness in the inspection department, though it calls for a lot of walking. He holds a perfect attendance record, is a hard worker and a rapid learner

I cannot say this defect has been very detrimental. The man has progressed on his job, shown initiative and stick-to-it-tiveness and performs his duties with little or no supervision.

"The defect has not prevented conversation in a noisy machine shop, and even over the telephone it is possible to converse freely with him.

"I would be glad to get more of his type."

Case 8. Polio Leg

"This slightly crippled woman works in the production department as a file-clerk. Her work is perfectly satisfactory and her handicap seems to act as a challenge to her in that she is the most dependable member of our office force as far as being at her job on time, every day, regardless of weather conditions; she travels by bus and then walks the same distance as other employees working here.

"I've often used her as an example to some of the 'stragglers' here in my department."

Case 9. Deaf Mute

"This man's performance as a drill press operator has been quite satisfactory. After a reasonable training period, probably slightly longer than for a normal man, he has been advanced to full-time in the group and functions to quite an extent like the others in the group. Some difficulty has come in the explanation of the jobs, but only to the extent of a little time in explanation.

"His time and effort seems to be more concentrated on his work, and less time lost during the operations than with normal men. He seems very studious and industrious. To see him at work or to see the work he has done, one would never realize his handicap."

All of our Westinghouse handicapped people are receiving standard wages. Their employment is not dictated by any show of humanitarianism. No favors are shown any of them. Each is expected to give full value for his wages. From the supervisors' comments you can see that they give a little more than full value.

There are certain considerations on which the successful development of handicapped workers depend:

Employ such workers as can safely be employed at some job in your plant. Some will have to be put to work at but moderately exhausting work, as line bench assembly and electric wiring assemblies. Some will have to have "sitting" jobs, others will be able to stand. Above all, help them over their self-consciousness; do not differentiate between them and physically normal workers.

A football injury left this assembler with a bone infection. Though scarcely able to walk, he's first at his bench in the morning, last to leave at night, and stays consistently at his work throughout the day

From the minute they walk into the reception center, treat them as any other physically normal worker.

It is necessary to do a skilled job of placement with these people. Plant policy and individual jobs should be studied by the personnel department, and the jobs that the physically handicapped can fill should be so marked. When a worker is hired in our plant a notation is placed on his personal record card telling the nature of his handicap and the type of job he is suited for. No foreman or shop supervisor is allowed to transfer a handicapped worker without an "okay" from the personnel department. You can readily understand the reason for this: a man with a heart condition who may be doing a non-exhaustive type of work might be inadvertently changed to heavier type of work which he could not stand.

The physically handicapped individual is contributing 100 percent plus to our war production. The statements of our Westinghouse supervisors prove this. Quoting from the late Edsel Ford's recent article in the *Saturday Evening Post*, "War and combat brooks no infirmities in men. The soldier in a plane, a tank or a fox-hole must be a thoroughly sound and sturdy physical being. But at home on the production line that bulwarks the fighting front, we are rapidly discovering that the physically handicapped man may be a splendid production soldier."

Cleaning Steps for Painting And Plating

BY C. W. SMITH, RESEARCH ENGINEER,
ALKALI DIVISION, DETROIT REX PRODUCTS COMPANY

PROCESSING LAYOUTS FOR METAL CLEANING—III

PROCEDURES FOR CLEANING STEEL prior to painting may be superficial or extensively detailed, depending upon the nature of the paint and the use of the painted part. In order to apply a continuous, non-porous paint film it is necessary to remove oil, rust, scale, moisture and dirt from the metal.

Adhesion of the paint film is frequently of great importance to the service life of the painted article. Some requirements for paint adhesion are very rigid because protection of the base metal from corrosion or abrasion is the primary objective rather than appearance. Treatment of steel to produce a rust-retarding phosphate coating and improve adhesion is thus an important pre-painting process. Development of correct properties in the phosphate coating rests upon proper cleaning technique.

Where are the three cleaning methods applicable as a preliminary to painting steel? Solvent degreasing can serve as the final cleaning operation prior to applying a prime coat or paint if the steel is free of rust and scale. Oil and moisture will be removed from the metal surface without leaving a film of cleaning material. Hence, good adhesion can be expected. By the same reasoning, solvent degreasing is suitable as the final cleaning step before phosphate coating, providing rust and scale are not present.

Likewise a mechanical washer employing an emulsion cleaning material will do a satisfactory job as the final cleaning step before painting or phosphate coating. Work cleaned with an emulsion retains a water-repellent film of solvent that prevents rusting during temporary storage of work before painting. This film also serves to control the size of crystals which form in some phosphate processes.

Alkali is also extensively used in mechanical washing machines, but unless an alkali film is left on the steel, the metal will rust if left standing in a moist atmosphere. Alkali films are objectionable under lacquer-type paints. If alkali is used for cleaning the best method is to do a thorough job of rinsing with soluble oil added to the last rinse to combat rusting if the work must stand before spraying or dipping. Extensive application is made of alkali in mechanical washers prior to phosphate spray processes.

As with mechanical washers, one or two rinses and a dry-off are required if alkali cleaning tanks are used for cleaning steel directly before painting. The pickling operation may follow, or a dip application of phosphate coating.

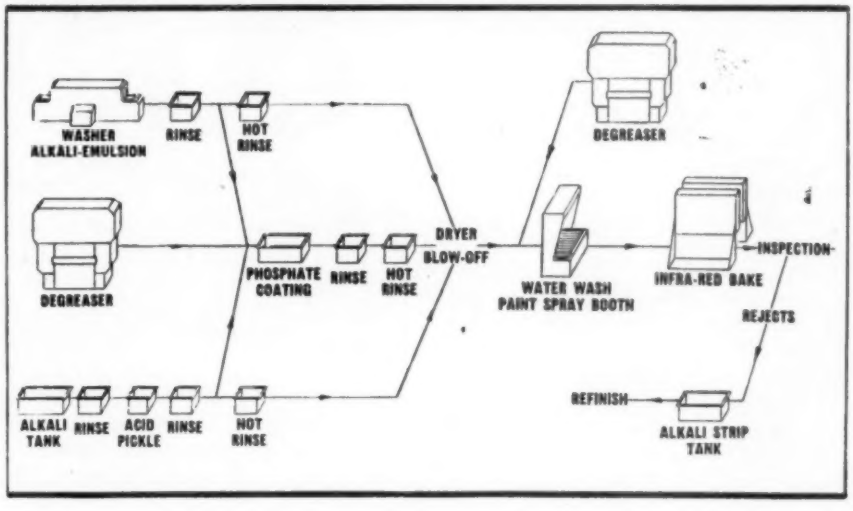
Alkalis are employed for two additional purposes in the processing of painted parts. In a water-wash spray booth, they are used to keep the pump and lines from clogging and to help settle or float pigment in the water reservoir tank. Rejected parts are stripped of paint with alkali materials. It is true that there are some paints that can be stripped more quickly or completely with solvent-type materials, but this operation is usually costly.

Work to be plated must be capable of being wet with a continuous water film, and be free of foreign matter, soap, oxide, salts and trapped cleaning solutions that might carry into the plating electrolyte. These requirements make it imperative that perfect cleaning be obtained. Many times, combinations of several cleaning methods are necessary to accomplish this end. The problem is to do the cleaning with the greatest margin of safety and in the most economical and efficient manner.

Removal of oil is not the only problem with cleaning before electroplating. Frequently, reaction products, occasioned by chemical attacks of the cleaning material on metal, must be removed, especially where decorative plating is involved. Any simple approach to the problem may be complicated by factors such as a combination of finishes, different types of plating solutions, the multiplicity of metal finishing compounds used and widely varying types of production processes.

Since care must be taken to preserve the finish on an article to be plated and yet remove large amounts of dirt and oil, most cleaning operations are designed for primary and secondary steps. Solvent degreasing, mechanical washing and alkali soak tanks are all employed for the primary step. The secondary step is always an alkali

CLEANING OF STEEL FOR PHOSPHATE COATING AND PAINTING



cleaning operation, usually employing direct, or cathodic, current as an aid to rapid and complete removal of any remaining dirt. Reverse, or anodic, current is often used to good advantage in the cleaning of ferrous metals.

The solvent degreasing method is flexible for many different requirements in primary cleaning. Trichlorethylene does not attack metals and will remove any oil or grease binder. The removal of insoluble dirt and emulsifiable oils from parts can be done by mechanical washing machines employing emulsion or alkali cleaning materials. The parts can be held directly on the plating racks making it unnecessary to re-rack the parts. High-pressure sprays directed at the significant surfaces are effective in removing imbedded buffing compounds and polishing dirt. Complete removal of such contamination may not be accomplished in the primary cleaning step, but the washing action does facilitate complete removal in the secondary, or alkali tank, cleaning operation.

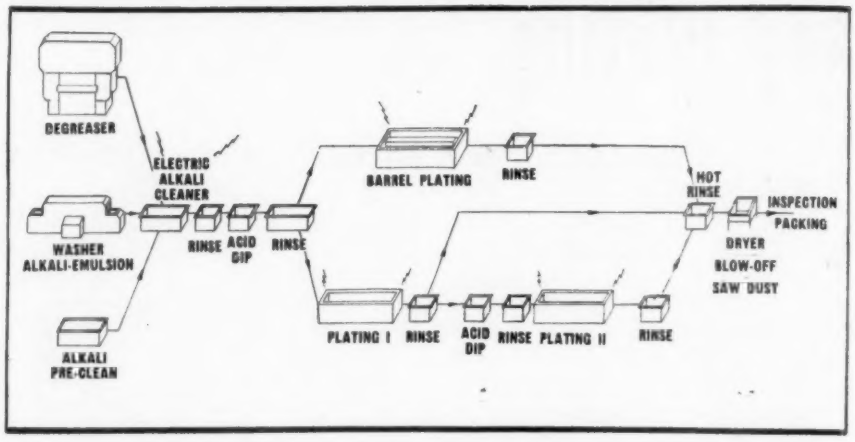
An alkali soak tank for primary cleaning is one of the oldest methods of insuring complete removal of oils and buffing compound. The bulk of the oil or compound on the work remains in this tank, thus avoiding contamination of the secondary, or final, cleaning tank before plating. Although a partial removal may be secured in the primary tank, the time of cleaning in the electric cleaner tank is cut to a minimum, which is important as a means of avoiding chemical attack of the metal in the electric cleaning cycle.

Thorough rinsing is an essential step between cleaning and acid dipping and again after acid dipping. A flow of water equivalent to a complete change three times per hour or oftener is necessary to avoid contamination of the following tank. This precaution should be taken throughout the plating cycle. Recessed areas, rack cavities and large surface areas otherwise rapidly carry over material from one operation to the next.

Work is often cleaned several times in the cause of its journey through the plating plant. Multiple deposits are sometimes buffed in the intermediate stage. Cleaning must be employed whenever a part is to be plated again after being handled.

The electric cleaner, sometimes used in both the primary and secondary cleaning step, must be suitable to the work in hand and properly operated to avoid work spoilage. Wide variations encountered in plant facilities make each application of cleaners an individual problem.

CLEANING OF METALS FOR PLATING



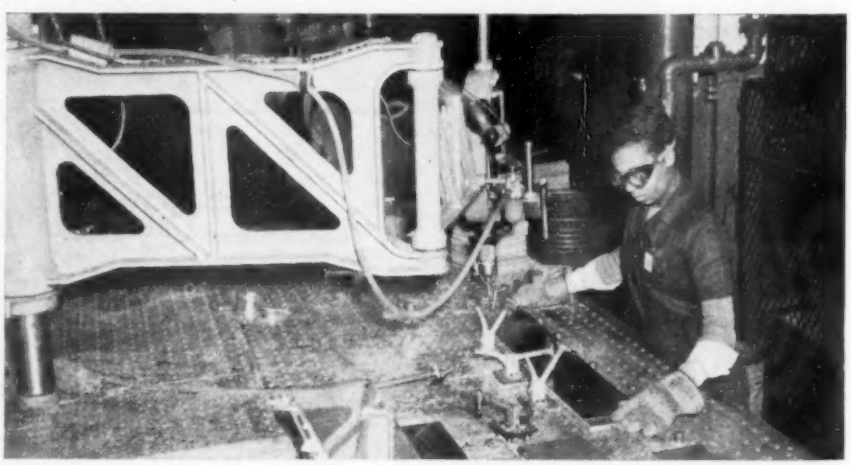
Work Table Saves Clamping Time

BY ALBERT KELLEHER
Tool Engineer, Linden Plant, Eastern Aircraft Division of General Motors

CONVENIENT SET-UPS when stack-drilling aluminum blanks are facilitated by the combination of an Onsrud swing-frame drill and a large steel-surfaced table in which ⅝-in. holes are drilled at 2-in. centers. Quick-acting clamps can be positioned anywhere on the table. Four prongs on the clamp base (the prongs are also on 2-in. centers) are inserted in the desired holes in the table and fastened down with 3/16-in. lagscrews. If formed parts are to be drilled, straps and buttons fitting the table holes are used for hold-down purposes—especially for the legs of channels.

Stacking up to ½ in. is permissible, depending on the material. The S1 grade cuts easier, can be stacked higher than the SO grade. It is best to place the sheet on a wooden backup, rather than on the table surface, to avoid marring.

By the use of locating stops, or bushings, placed in the table, it is possible to drill holes so that they will coordinate with the outline routed in a subsequent operation. The edge of the blank and the edge of the drill plate are positioned against the stops before clamping the work. In some cases the blank is later cut into two parts.



Many sizes and shapes of blanks can be set up quickly for stack drilling with this equipment. Stops are shown placed in the table holes to position the blanks and drilling templet so that the holes will coordinate with the outline to be routed in a subsequent operation

Development in Stretch Presses

BY C. L. FENN, CHIEF TOOL ENGINEER, EDO AIRCRAFT CORPORATION

Courtesy Engineering and Research Corporation

The 300-ton Erco hydraulic stretching press has clamping jaws 99 in. long and can be set for a minimum distance between jaws of 24 in. or a maximum distance between jaws of 80 in. The platen has a maximum vertical stroke of 12 in.

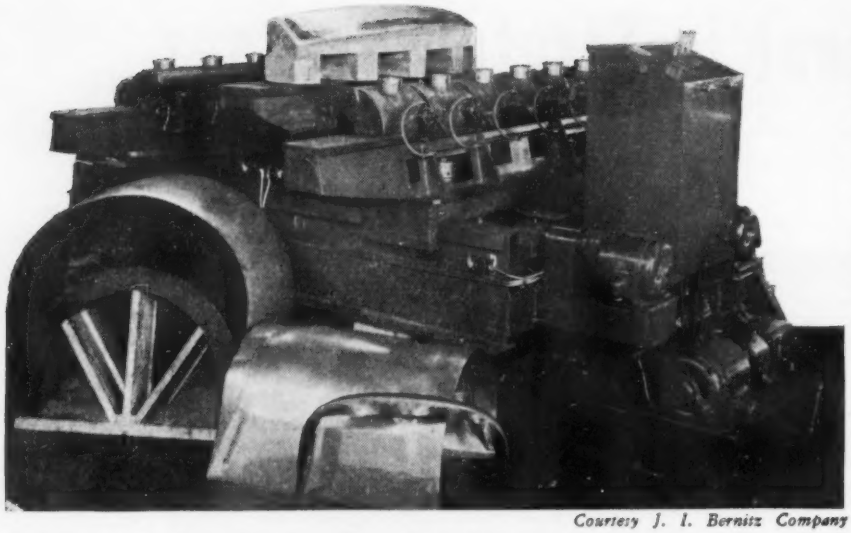
Stretch presses are now available with an infinite number of ram speeds. They will form heavy gage metal in the lengths and widths needed in the fabrication of large airplane sections

THE STRETCH PROCESS, now being used extensively in the aircraft industry, has been considered by some production engineers as a new development. However, the arch press, which has been used in this country for more than half a century, operates basically on the stretching principle. The same principle is employed in many draw dies of the diaphragm stretching type.

About twenty years ago the Junkers Company in Germany developed a stretching machine that was used in connection with the manufacture of aircraft parts. Soon after this machine was put in operation, units of a similar type appeared on the American market. These machines were used to some extent during the early 1930's, but it required the pressure of a full-scale war to persuade tool engineers and production supervisors in aircraft plants that there were unexplored possibilities in this process. Recent developments in the application of the stretch press have led both to a broadening of the field of usefulness for the process, and to the development of new and improved types of stretching machines.

Stretch presses now available have tonnage capacities which permit stretching heavier gages of materials in the greater lengths and widths required by present-day large airplane structures. Control of the press rams has been improved by the substitution of flow control valves or adjustable delivery pumps for the stiff, cumbersome mechanisms previously used. This improvement permits an infinite number of ram advance speeds, within the limitations of the machine, and is a vital factor in the success or failure of the application of the stretching process to a given job. A small change of ram speed, often equal one unit of adjustment of a flow control valve, sometimes means the difference between tearing the sheet and producing a perfect part.

The stretching process is primarily useful for forming sheets which must have a double curvature. There are several other methods by which this can be accomplished. These are: (1) by using diaphragm draw dies, (2) by using drop-hammer dies with plywood "pancakes," which operate very



Courtesy J. I. Bernitz Company

A sheet 96 in. long can be clamped in the jaws of the Bernitz hydraulic stretch press. The jaws may be set a minimum of 20 in. and a maximum of 80 in. apart. The two rams exert a total pressure of 150 tons and have a maximum vertical stroke of 12 in.

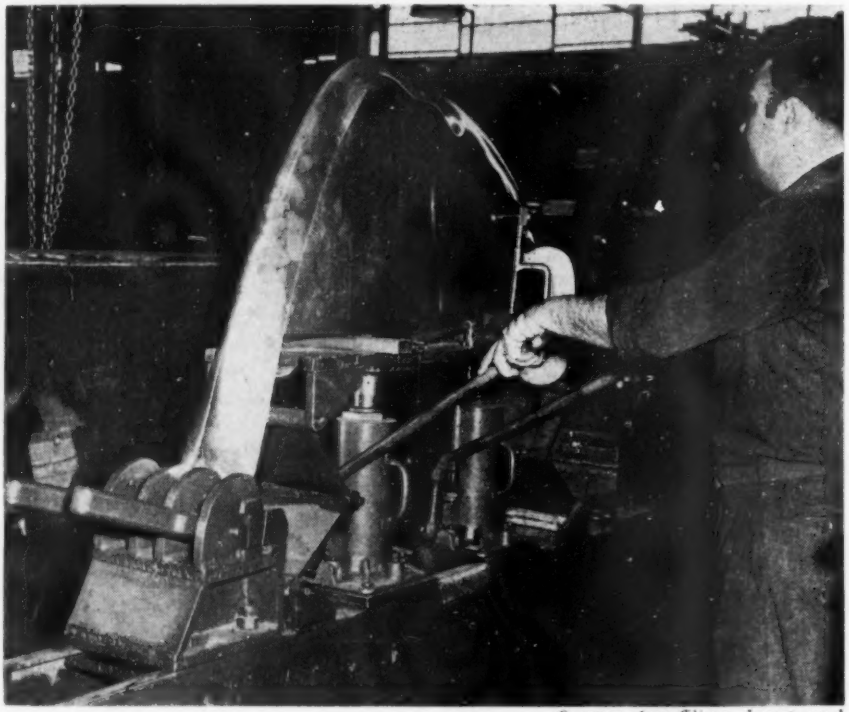
much like draw dies in a blank holding press, and (3) by means of form blocks which are pressed into a rubber cushion under heavy tonnage. The first two of these alternate methods use the same basic method for forming sheet—by stretching it—while the third, forming in rubber, involves a bending stress instead of tension stress with a large increase in the amount of spring-back over parts formed by one of the stretching methods.

In any of the stretching methods, it is essential that every fiber in the sheet be stressed beyond the yield point, and that the strain be greater than that necessary to produce the yield stress. When these conditions are fulfilled, parts will be formed which will have an almost irreducable minimum of spring-back. Stretch presses accomplish this desired result without the use of a draw ring or pressure pads. In fact, some of the sheets which currently are being formed in stretch presses are so large, and have such a deep draw, that the cost of conventional hydraulic or mechanical ppress equipment of sufficient capacity would be prohibitive.

A large variety of parts for aircraft and airplane accessories now are being formed by the stretching process. Some of these are shown in the accompanying illustrations. They include sheets for seaplane floats, wing tip bows, engine cowl sections, fuselage skin sections, landing gear fairings, sections of exhaust manifolds and pilot's cockpit enclosures, wing and stabilizer leading edge skins adjacent to the tip where the leading edge starts to sweep back into the tip curve, and similar parts. Several different types of stretching machines are available for producing these parts—selection of the machine to be used should be based on the quantity and variety of work to be done, as well as on expected production rate.

The "Erco" stretching presses made by the Engineering and Research Corporation consist primarily of hydraulic cylinders placed beneath a table or platen which is located between two rows of independent clamping jaws. They are produced in 75, 150 and 300-ton capacities, and sometimes are operated in tandem so as to double their capacities. In operating the "Erco" press, a form is fastened on the table and the metal sheet to be stretched is placed over the form and securely clamped in the jaws on either side. Pressure is then applied to the hydraulic cylinders, causing the table to move upward and stretch the sheet tightly over the form. Jaw carriages can be provided which permit yawing the jaws with reference to the form block while the sheet is being stretched. The table is pivoted on a piston-type center guide so that it may be tilted by individual control of each of the two pressure rams.

The 150-ton capacity hydraulic stretch press made by the J. I. Bernitz Company also is of the vertical-rising-table type, with the form block being pushed up into the sheet during the forming operation. The sheet is held by six clamping vises on each of the two crossbeam carriages. The vises have rounded ends, so that they may be set with the centerline of the jaws on the arc of a circle and still not have an appreciable distance between the jaws at their centerline. This fea-



Courtesy Aeroaffiliates, Incorporated

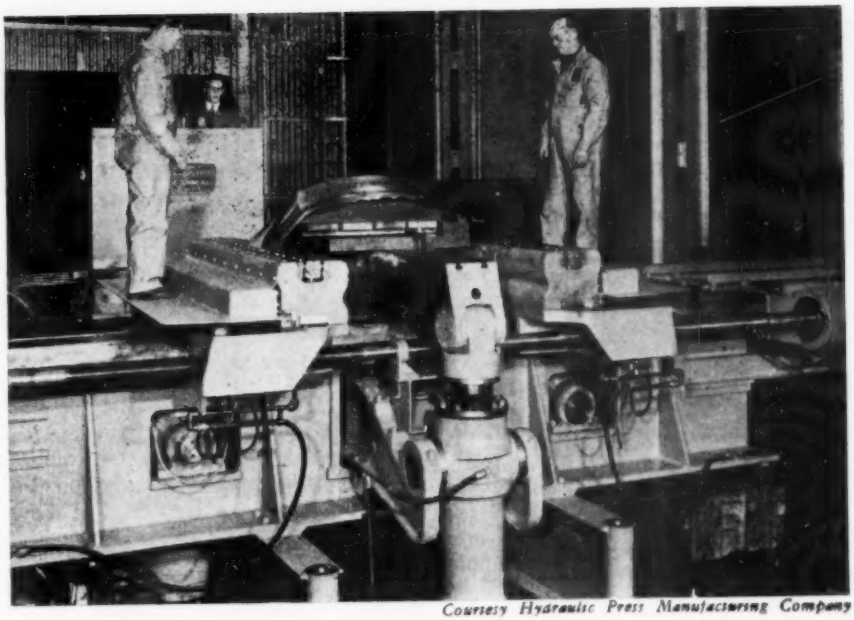
Developed originally for stretch-forming wing tip bows, this hand-operated stretch press can be used for forming other small parts. It exerts a maximum pressure of 40 tons and can be set with a minimum distance between jaws of 54 in. or a maximum distance of 90 in. Clamping jaws are 10 in. long

ture is helpful when stretching sheets with curvature on the sides in plan view. Jaws on both the Erco and the Bernitz machines are self-energizing, and are actuated by double-acting pneumatic cylinders. The vise carriages on the Bernitz machine can be yawed with respect to the centerline of the platen and may be moved toward or away from the platen by means of motor-driven leadscrews. The form block platen also may be tilted by proper manipulation of the separate hydraulic circuit controls for each of the two vertical-acting rams.

One of the recent developments brought out by the Bernitz organization is a special stretch press which has a minimum distance between jaws of only 5 in. This feature considerably increases the field of application of the press, as it makes it possible to stretch tail surface and wing panel nose skins, and long narrow fairings.

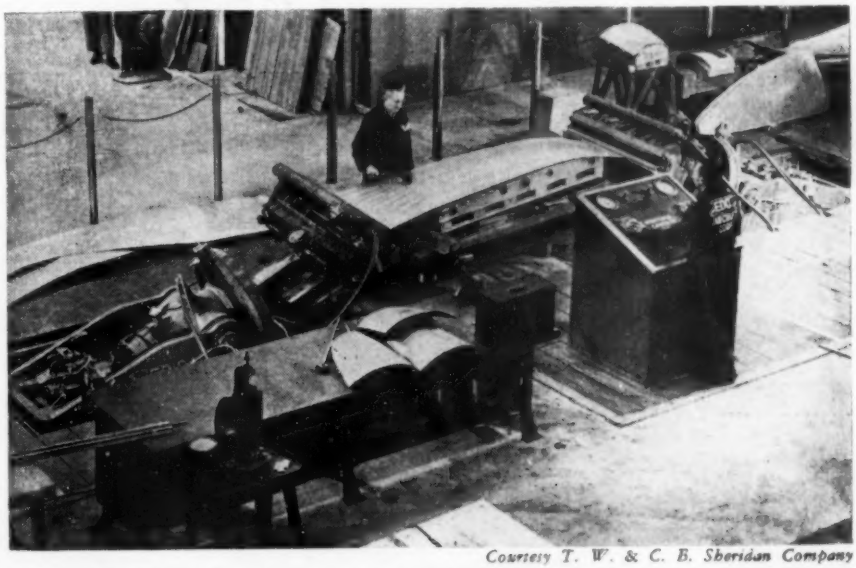
An inexpensive stretch press originally developed in Sweden by A. S. Blumenthal, and first used in this country by the Fairchild Aircraft Corporation, now is being manufactured under license by Aeroaffiliates, Incorporated. This machine is of the upward moving platen type in which the table is actuated by two hand-operated hydraulic jacks, each with a capacity of 20 tons. The table is restrained from sidewise movement by large welded hinges at each end. This type of articulated mechanism furnishes at low cost flexibility of movement in the directions required. The sheets are held by manually operated, self-energizing gripper jaws of the sliding wedge type. While the machine primarily is designed for single-purpose use, it may be adapted to longer forms by moving the gripper jaws along the base channels and bolting them.

Like the Erco and the Bernitz presses, the 150-ton H-P-M stretch press made by the Hydraulic Press Manufacturing Company has an upward moving platen. In this machine, however, there are two 75-ton rams on the longitudinal centerline of the main-base channels and two additional 75-ton rams on a centerline at 90-deg. to that centerline. This arrangement permits setting the platen in two positions in reference to the gripper jaws, which are mounted along the top surface of the base I-beams. The two sets of rams makes possible the support of long blocks over which sheets are to be stretched longitudinally, while also making it possible to provide proper support for small, approximately square dies. This feature is useful in preventing deflection or breakage of form blocks when heavy-gage sheets are stretched. The rams supporting the platen are pivoted so that the table may be tilted by the separate control provided for each ram.



Courtesy Hydraulic Press Manufacturing Company

Right- and left-hand fillets are being stretch-formed simultaneously from a single sheet in this set-up on a 150-ton capacity H-P-M hydraulic stretch press. Rams have a maximum stroke of 24 in., and the 84-in. long jaws can be positioned a maximum of 150 in. or a minimum of 28 in. apart



Courtesy T. W. & C. B. Sheridan Company

A double-fluted float bottom sheet is shown being stretch-formed in a Sheridan press in an aircraft plant. It has jaws 48 in. long which can be set from 24 to 267 in. apart. Each tension ram has a maximum stroke of 20 in.

The clamping jaws used on the H-P-M stretch press are each 84 in. long and are designed so that the gripping action is produced by hydraulically actuated toggles. A "bead" is provided in the gripping jaws so that the metal can be positively held. The jaws are initially positioned by large motor-driven leadscrews. In addition, the jaws have a hydraulically controlled motion provided by cylinders at the ends of the leadscrews. After the draw has started, hydraulic pressure can be used to resist the movement of the jaws toward the center of the machine—or, by the application of pressure, the jaws can be forced either forward or back.

Basically different from others on the market, the hydraulic stretch press developed by the T. W. & C. B. Sheridan Company applies load to the work

by means of tension rams which are mounted on trunnions. Each jaw may be elevated through an arc about the trunnion pin, from a horizontal position to a position 15-deg. past the vertical. Elevation of each jaw unit is accomplished by hydraulic cylinders. Each jaw unit slides on top of the I-beams that form the primary structure of the machine. These units are positioned along the base by motor-driven leadscrews controlled by pushbuttons. Gripper jaws on each unit are self-energizing, and are pneumatically actuated in both directions.

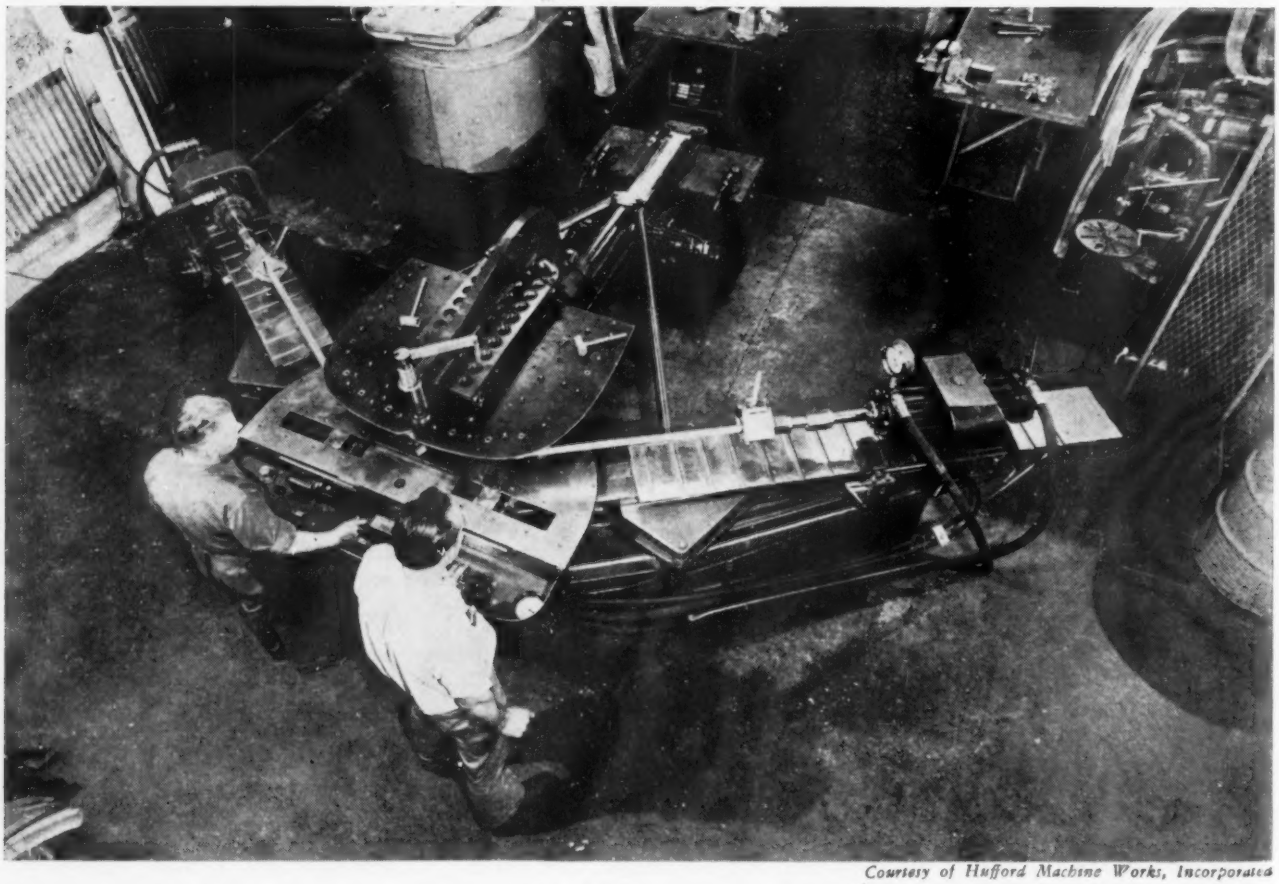
The platen between the two jaw units is supported on three hydraulic rams. The left-hand ram is separately controlled, while the two right-hand rams move as a unit. This feature enables the operator to set the form block quickly to optimum height and angle, and to obtain the best pull of the sheet over the form block by adjustment of the tension cylinders.

The Sheridan stretch press is shown set up to stretch float forward bottom sheets, which are long and have little camber in the fore-and-aft direction. The machine is well suited for this type of work since the die remains stationary throughout the stretching operation and the pull from each end acts in a constant direction, giving no change in the optimum angle of pull over the ends of the form block. In addition, the Sheridan machine can be used in the same way as a conventional upward-moving ram press. When used in this manner, the jaw ways are set approximately vertical, and the table is elevated by its three supporting rams. These rams have a stroke of 82½ in. and a total capacity of 120 tons.

For stretching small, highly cambered parts, such as nose cowls with a diameter less than the length of the die table, the platen is placed on the large single ram and attached to it by a trunnion pin at the center of the table. The platen and ram are then swung 90 deg. and the platen elevated by the ram until it is above the vertically-adjusted jaws. Cowls as small as 24-in. diameter may be stretched in such a set-up. In the case of form blocks that are trapezoidal in plan view, such as for the after section of a fuselage, the jaws may be yawed so they are parallel to the tapering sides of the form block.

The Hufford bending and beveling machine contours and bevels extrusions, rolled sections, flat strips, and sheet stock up to 10 in. wide. The workpiece is placed under heavy tension, exceeding the elastic limit of the metal, and at the same time is bent or simultaneously bent and beveled around a stationary form block. Tension is maintained until the part is completely formed and ready for removal from the die.

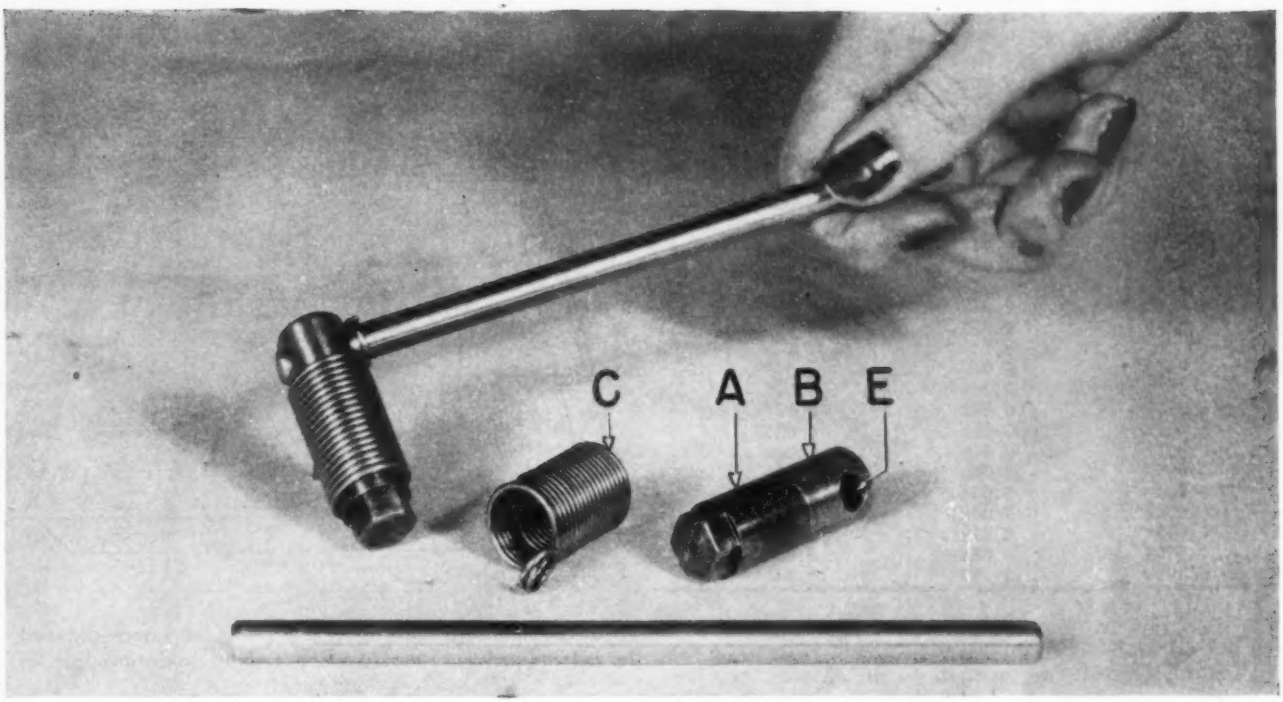
This machine consists essentially of a stationary table carrying the forming die, and two simultaneously actuated arms which are hydraulically operated and hinged to the table. Pivotal positions of the arms are adjustable for workpieces of various radii. Each arm carries a separate hydraulic "stretching" cylinder, which is adjustable for position along the arm to accommodate various work lengths. Each cylinder is equipped with an adapter in which grippers can be inserted for holding the workpiece. All main controls are contained in a single panel at the front of the machine.



Courtesy of Hufford Machine Works, Incorporated

The two arms of the Hufford machine are hinged to the table and are actuated in unison to bend or bend and bevel simultaneously such parts as extrusions, rolled sections, flat strips, and sheet stock up to 10 in. wide. Parts can be bent 180 deg. around the form block

Ideas From Practical Men

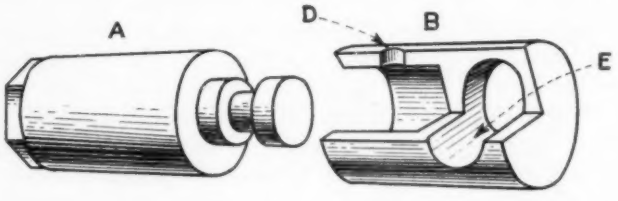


The tightly coiled spring replaces the toothed wheel and pawls on the usual ratchet wrench

Coiled Spring Works Ratchet Wrench

BY RAYMOND HODGE

When inspectors and maintenance men in the induction furnace department at General Electric's Schenectady Works found it necessary to reach hollow-head screws in out-of-the-way places, the illustrated "ratchetless" ratchet wrench was designed. Unlike the usual ratchet wrench with a



toothed wheel and pawls, this wrench depends on the clutch action of a tightly coiled spring that permits one-way rotation only.

The body of the wrench is comprised of two cylindrical parts *A* and *B*. The wrench was made to accommodate a ½-in. hexagonal head, but any adapter may be used in place of the hexagon for other screws. When part *A* is inserted in part *B*, a pin through *D* and extending into the groove of part *A* permits free turning without separation.

Spring *C* is wound tightly on a mandrel 0.005 in. smaller than the diameter of parts *A* and *B*. The spring is pressed over *A* and *B*, with the loop of the spring over drilled hole *E*. Inserting a 5/16 in. rod through the loop and into hole *E* locks the looped end of the spring with respect to part *B*.

If the spring is wound clockwise, then any clockwise turning of the rod tends to tighten the spring, thereby tightening the grip of the spring on part *A* and giving it the necessary rotation to tighten the hollow-head screw. Turning the rod counterclockwise loosens the coils of the springs, permitting *B* and the spring to turn backwards on part *A*. By a series of short back-and-forth movements of the rod, it is possible to drive the screw. A similar wrench with the coil spring wound counterclockwise is used for removing screws.

Simplifies Taper Elimination When Grinding

BY RALPH WAECH

Alignment of the swivel table on grinding machines can be done quickly with the aid of an indicator and tabulated figures which give the necessary table movements to remove taper from the work. This is especially useful when various jobs have to be set up on the grinder throughout a working day. The indicator is mounted at a convenient place against a far end of the swivel table so as to receive the side movement of the table. The constant measurement from the pivot point on the table to the radius at the indicator is used as the foundation for the table settings.

The accompanying three-column table is based on a distance of 40 in. from the indicator to the pivot point on the swivel table of the grinding machine. Column 1

SWIVEL TABLE MOVEMENTS

Taper per inch, in.	Taper in 40 in., in.	A-line movement, in.
0.00001	0.0004	0.0002
0.00002	0.0008	0.0004
0.00003	0.0012	0.0006
0.00004	0.0016	0.0008
0.00005	0.0020	0.0010
0.00006	0.0024	0.0012
0.00007	0.0028	0.0014
0.00008	0.0032	0.0016
0.00009	0.0036	0.0018
0.0001	0.004	0.002
0.0002	0.008	0.004
0.0003	0.012	0.006
0.0004	0.016	0.008
0.0005	0.020	0.010
0.0006	0.024	0.012
0.0007	0.028	0.014
0.0008	0.032	0.016
0.0009	0.036	0.018
0.0010	0.040	0.020
0.0011	0.044	0.022
0.0012	0.048	0.024
0.0013	0.052	0.026
0.0014	0.056	0.028
0.0015	0.060	0.030
0.0016	0.064	0.032
0.0017	0.068	0.034
0.0018	0.072	0.036
0.0019	0.076	0.038
0.0020	0.080	0.040

lists the taper per inch found in the work, while column 2 lists the corresponding taper in 40 in. When taper has to be eliminated from the part being ground, one-half of the taper in 40 in. will have to be taken up at the indicator. These adjustments are listed in column 3.

The table is used in the following manner: Presume that the micrometer readings at each end of a 5.4 in. shaft showed it to have 0.0013 in. taper. The taper per inch would be 0.0013/5.4 or 0.00024 in. The table shows that a taper of 0.0002 in. requires a movement of the swivel table on the grinding machine, while a taper of 0.00004 in. requires a movement of 0.0008; therefore, the swivel table must be moved 0.0048 in. at the indicator.

On grinders that have seen long service, there may be some eccentric wear on the pivot pin, in which case slight variations will result from the calculations listed in the table. Even in such instances the use of an indicator and a calculated table of adjustments will eliminate much of the trial and error when eliminating taper from work set-up on a given grinder.

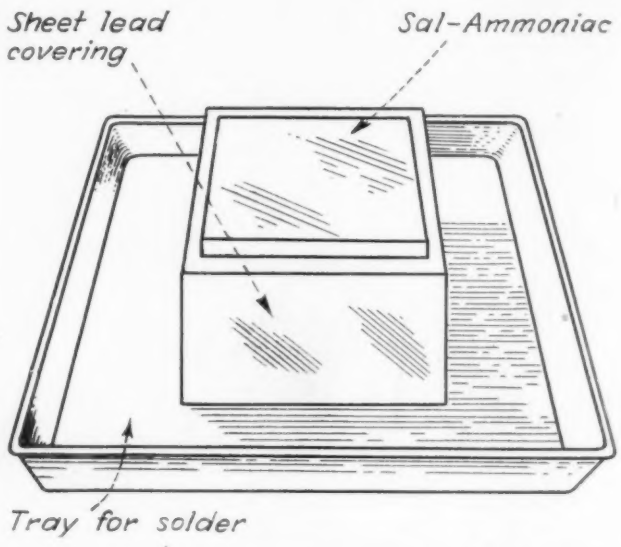
Reclaiming Solders When Tinning Coppers

BY A. EYLES

While in charge of a sheet-metal fabrication shop employing 75 men, I noticed a considerable loss of solder when men tinned their soldering coppers, since globules of solder would fall to the workbench or floor. To prevent this loss, pans or trays of galvanized steel were made as shown in the drawing. They are 6 in. square and 1 in. high, and in the center a sal-ammoniac block is incased with sheet lead soldered to the bottom of the tray. Every time the soldering coppers are tinned, the surplus solder falls into the tray. As the sal-ammoniac is used up, the lead casing is melted down simultaneously with the tinning of the soldering copper.

At the end of each month, approximately ½ lb. of solder collects in each tray. This is collected and reclaimed when a new block of sal-ammoniac is soldered in position. The galvanized tray lasts indefinitely.

A method often practiced when tinning soldering coppers is to dip the heated tool into a solution of zinc chlor-



A sal-ammoniac block encased in sheet lead and soldered to a tray prevents waste when tinning soldering iron or coppers

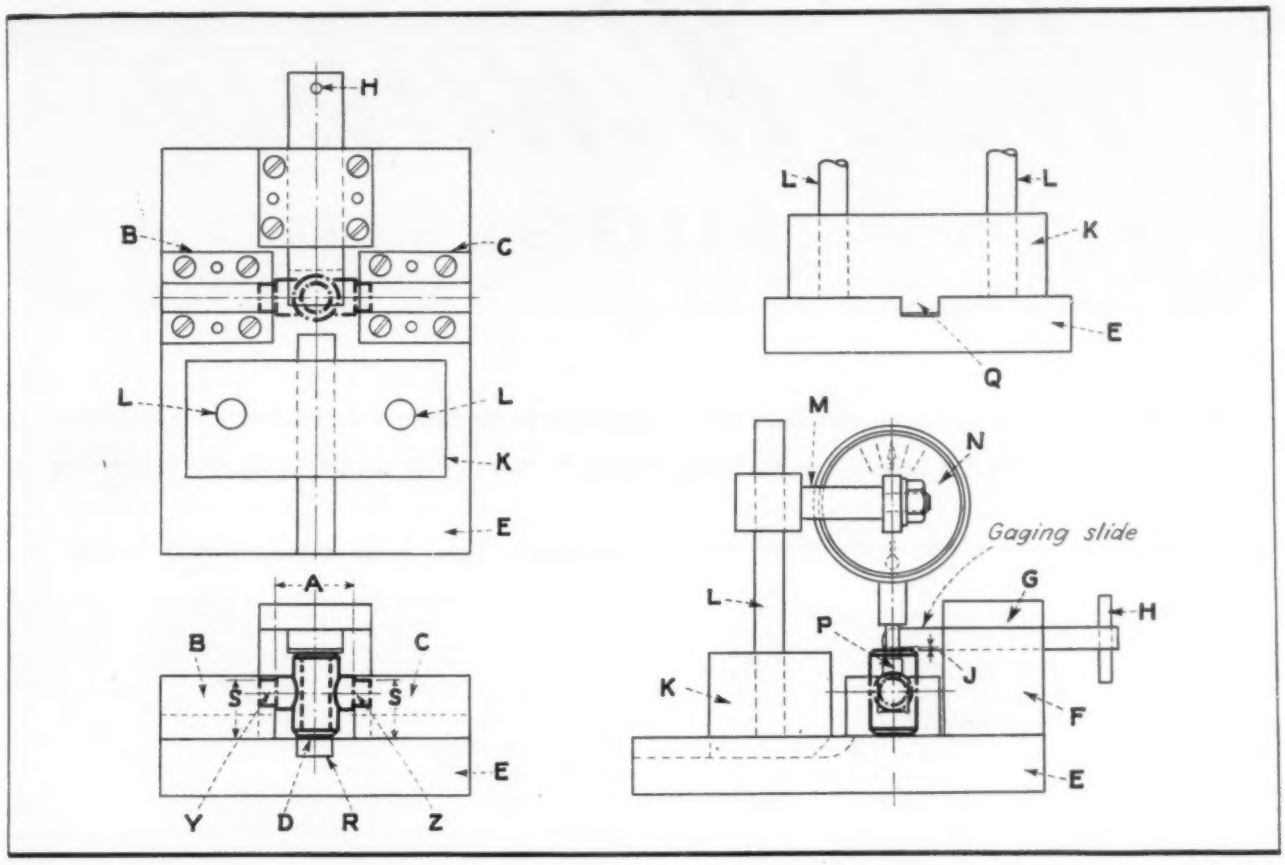
ide and then apply solder to the working faces. The copper is then again dipped into the liquid in order to spread the solder evenly. When following this practice, the flux becomes contaminated with dirt and copper salts, rendering it unfit for fluxing many classes of sheet metal.

Length and Centrality Gage for Trunnions

BY FRANK HARTLEY

The illustrated fixture is used to check the length of the hub and the centrality of the two bosses relative to the ends of the trunnion casting shown by heavy dashed lines. The casting is machined at *Y* and *Z* up to the shoulders at line *A*. From these finished ends, the work is centered in two blocks *B* and *C* while resting on the lower end of the hub at *D* against base *E* of the gage. Mounted on base *E* is gaging block *F* in which is placed a feeler type of gaging slide having a step on its end to check the over-all length of the hub within "go" and "not go" limits. The slide is held in place by cap *G*, and is moved in or out of gaging position by handle *H*. The gaging step on the slide is shown at *J*.

In addition to work locating blocks *B* and *C*, there is a slidable block *K* tongued and grooved into the base block in such a manner that it can be removed from the position shown to the edge of the block when placing the work in the gage. Block *K* carries two posts *L* on which are mounted two indicator gage supporting arms *M*, only one being shown in the drawing. One dial indicator is shown at *N* attached to support *M*. It is to be understood that there are two of these, one mounted on each post *L* and used to check each boss, either *Y* or *Z*. The



This gage is used to check the length of trunnion hub and to determine if the trunnion arms are central on the hub

contact point of the indicator is shown touching the work at *P*. Tongue *Q* enters groove *R*.

In using this gage, the work is placed in the position shown with block *K* carrying the dial indicators moved to the left end of the base. The gaging slide is moved over the end of the hub to see if its length is within step *J*. Block *K* is then brought forward so that the indicator points *P* are over the respective bosses *Y* and *Z*. Dial readings will then show if the bosses are in line and at the correct distance from the end of the hub, as indicated by dimensions *S*.

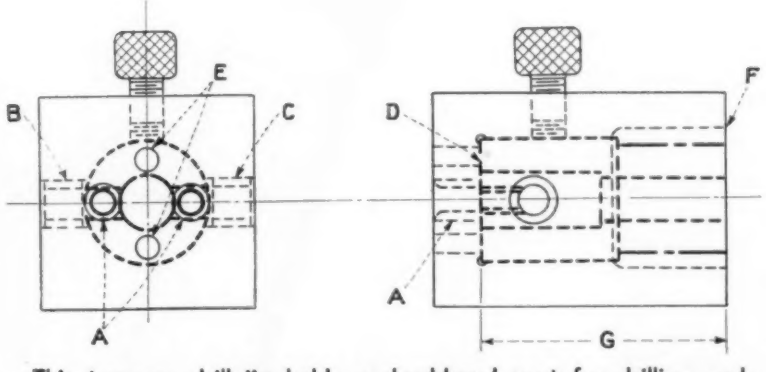
Two-Way Drill Jig for Right-Angle Holes

BY F. SCRIBER

Recently we had to drill two holes in the side of a shouldered post, and then drill and tap two holes in the top of the post square with the side holes. The drill jig shown in the drawing, with the work indicated by heavy dashed lines, was designed to hold the hole locations within specified limits. The two tapped holes in the large end of the post are located by spot drilling, tap-size drilling and then tapping through bushings *A* at the closed end of the jig. The two side holes are drilled through bushings *B* and *C*.

The work is placed in the jig from the right-hand or open end, and is seated against shoulder *D*, in which position it is secured by the knurled head screw. Should work stick in the jig, pins can be inserted in holes *E* for driving it out.

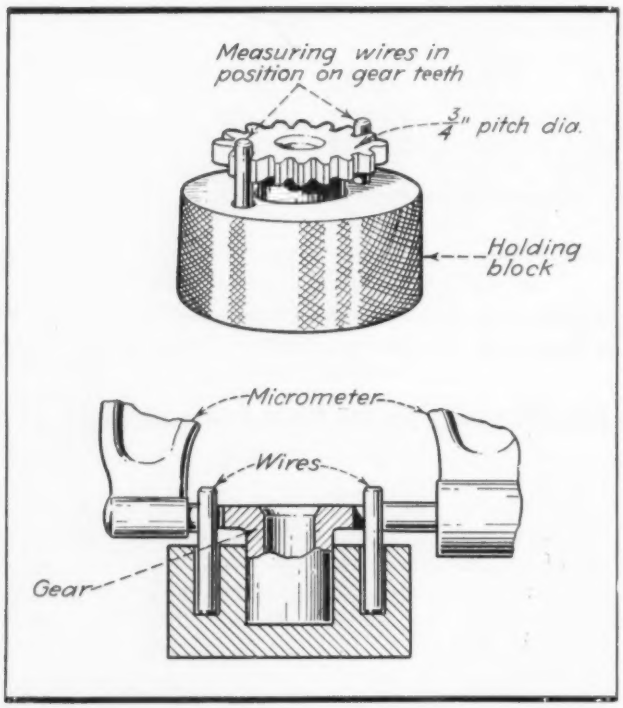
Holes *B* and *C* are drilled while the jig is resting on the side opposite the hole. Holes *A* are drilled and tapped with the jig resting on surface *F*. Surface *F* is so machined in respect to the depth of the hole that dimension *G* is a few thousandths of an inch greater than the length of the work. For practical purposes, the thrust when drilling holes *A* is taken directly against the end of the work.



This two-way drill jig holds a shouldered post for drilling and tapping holes at right angles to each other

War Winning SUGGESTIONS

The following ideas were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to its war production.



Measures Diameter of Thin Gears Quickly

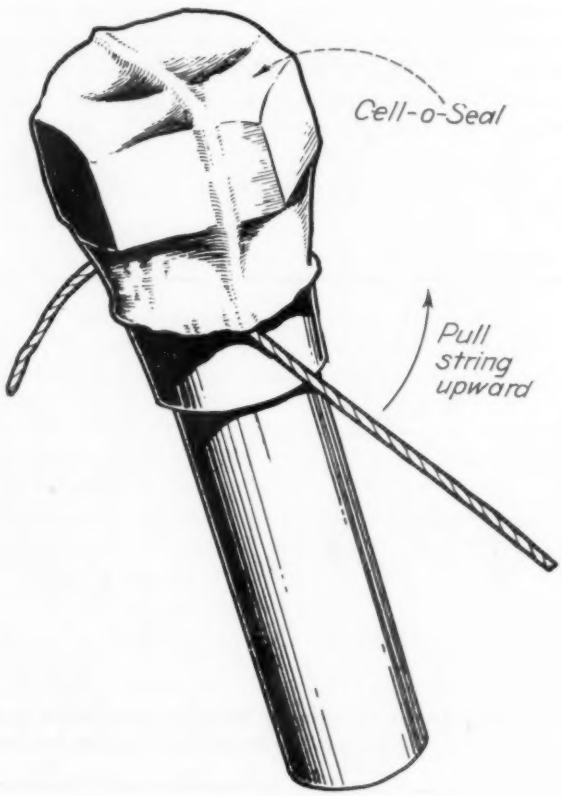
The pitch diameter of the small gear shown in the drawing is checked over wires, but because the gears are very thin it is difficult to hold the wires in place and simultaneously adjust the micrometer. The illustrated holding block was designed so that when the gear shaft is placed in the center hole, the two pins approximately make contact with the gear teeth at the pitch line. There is sufficient looseness in the fit of the shaft in the center hole and the fit of the two pins in their respective holes to allow lateral movement so that when the micrometer is adjusted over the pins an accurate measurement of the pitch diameter can be made.

It takes about five minutes to measure one of these gears without the aid of this holding block. With the block, the measurement can be taken in one-half a minute. *Suggested by Woodrow Juzek, Aircraft Engine Division, Packard Motor Car Company.*

Hydraulic Tube Seals Removed With String

The quickly removable tubing seal shown in the illustration is used to protect the end threads and seal the interior of hydraulic tubing used in aircraft. When the tube is made, a string or strong thread is placed over the screw-thread end and wet Cell-O-Seal is placed over the string. When the Cell-O-Seal dries it shrinks and becomes air tight.

The improved seal illustrated replaced the Cell-O-Seals without string. These old-type seals were frequently removed with knives, screwdrivers or other metal tools, inadvertently marring the flare or screw threads. Furthermore, fragments of the seal would enter the tube. The alternate practice was to remove the seals with the finger nails, which also allowed fragments of the seal to enter the tube.



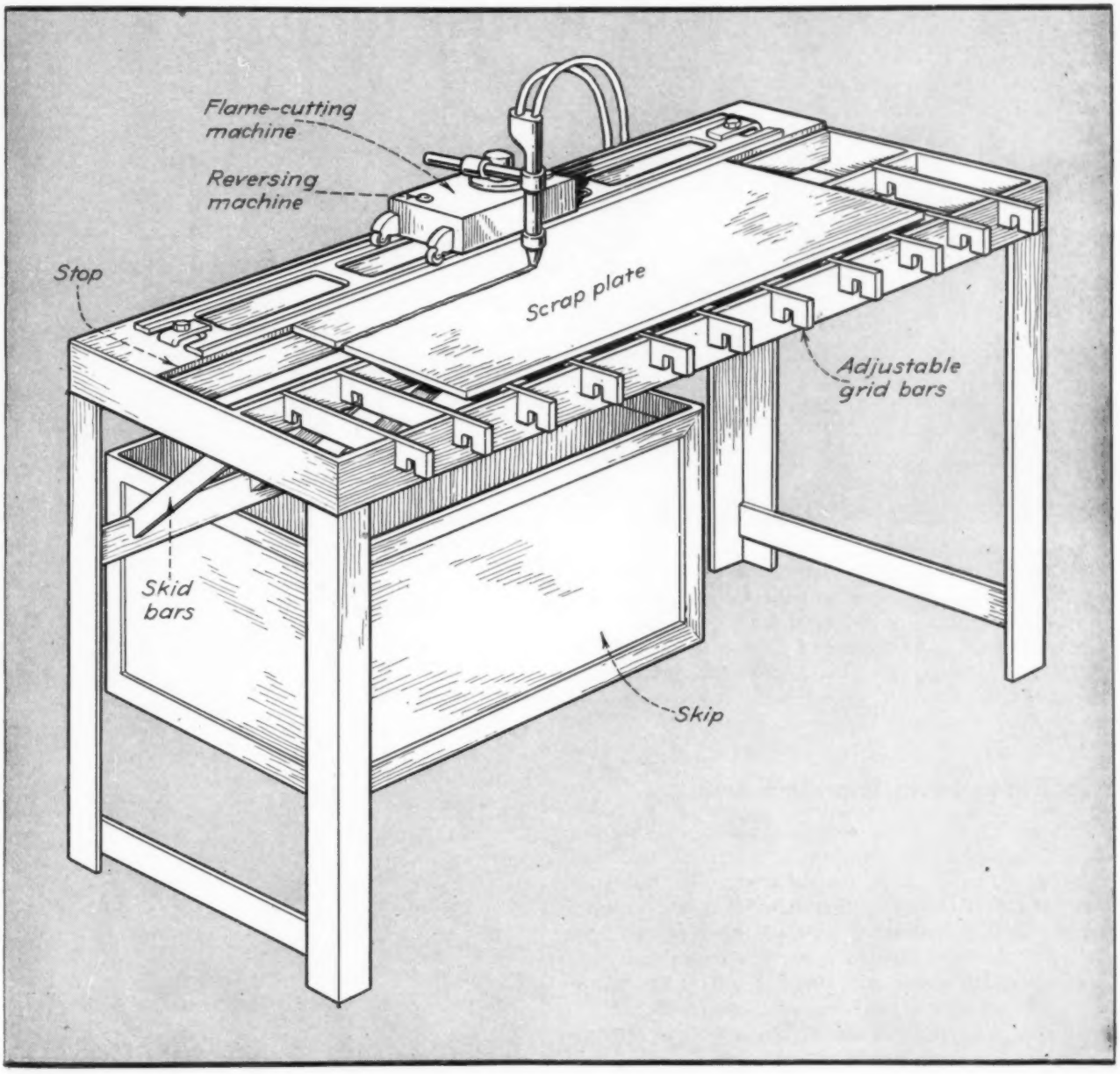
The new seal requires slightly more time and effort to apply, but saves considerable time on the assembly line, where it is removed immediately before installing the hydraulic tubing on the airplane. *Suggested by Granville Baum, Airplane Division, Curtiss-Wright Corporation.*

Production of Ship Plates Increased

One of the hindrances to maximum production in shipyards has been the scarcity of "strongbacks" used in fairing up butt joints between plates. They are made from scrap ends of heavy shell plate and must be flame cut with opposite longitudinal edges straight and parallel. It is customary to haul scrap shell plate from the plate shop to a salvage area, usually at some remote place in the yard, and there segregated and process the strongbacks. They must then be loaded in skips and returned to the shipways. This involved handling contributed most to the shortage of these ship elements during construction on the shipways.

The output of strongbacks has been doubled, and production on the shipways has been increased proportionally, by the illustrated automatic flame-cutting unit for strongbacks which is set up adjacent to the tables on which the shell plates are shaped. A torch dolly runs on a track parallel to a stop for locating the scrap material.

After being placed on the table, the scrap plate is pushed forward against the stop, whereupon the torch dolly is started along the track so as to flame cut the plate longitudinally. As soon as the cut is completed, the strongback drops through a gap in the table and slides along inclined rails or skid bars into a skip. The plate is again pushed forward against the stop. A strongback is produced at each traversal of the torch. *Suggested by Maude Knight, Permanente Metals Corporation.*



Fixture Holds 30 Cut-Off Tools for Grinding

Sharpening cut-off tools singly proved to be a slow expensive job and developed into a bottleneck when the tools could not be obtained in sufficient quantities from venders. Therefore, the illustrated grinding fixture was built to hold 30 tools for simultaneous grinding.

The fixture rocks on trunnions fitted to end brackets

bolted to the machine table. After the cut-off tools are aligned, the cap is tightened and the fixture tilted as required so the tools can be sharpened and lipped.

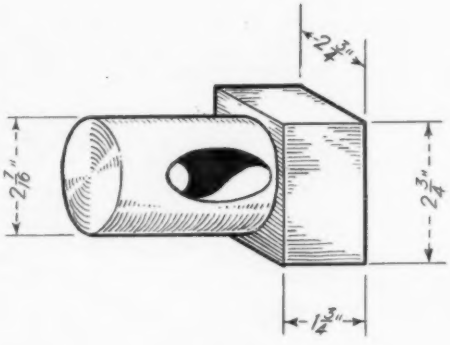
Because of the large number of these tools used in the plant, this fixture has saved five hours every 24-hour day, 30 hours each week, or 1,500 hours a year. *Suggested by Merrel Kern, Caterpillar Tractor Company.*

Simplified Hydraulic Drawbench Jaws

The jaw block normally used in hydraulic drawbenches has a slotted cylindrical shank and a rectangular head, and is machined from a square block of steel. The machining operations involve turning, shaping, milling and drilling, followed by heat-treatment. This jaw block is shown in Fig. 1. It has been replaced by the one shown in Fig. 2, which is wedge-shaped and sawed directly from square steel stock. No other machining operations are needed.

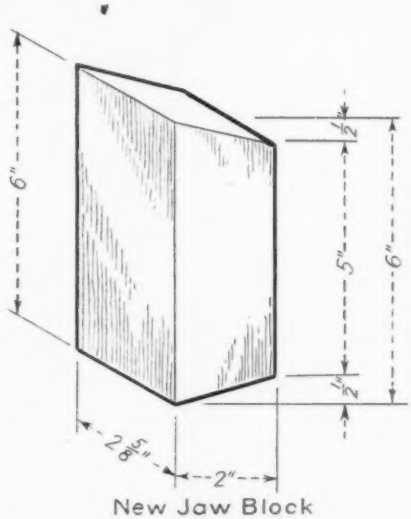
In addition to saving on the jaw blocks themselves, there is an even more substantial saving on the hydraulic drawbench piston rods. The old-style jaw block butted against the piston rod and the constant hammering caused fatigue breaks in the rod at the keyway. This necessitated removal of the piston rod and the welding and machining of new end pieces. The new jaw blocks do not butt against the piston rod, and maintenance costs are therefore greatly reduced. There is also a saving in the steel needed for piston-rod end pieces, since few replacements are necessary.

It is estimated that a saving of 500 man-hours per year and 400 lb. of steel is realized by the new method of making the jaw blocks. An additional estimated saving of 600 man-hours and 600 lb. of steel is expected each year by reducing work on the piston rods. *Suggested by Alvin J. Schmedlin, Bridgeport Brass Company.*



Old Jaw Block

FIG. 1



New Jaw Block

FIG. 2

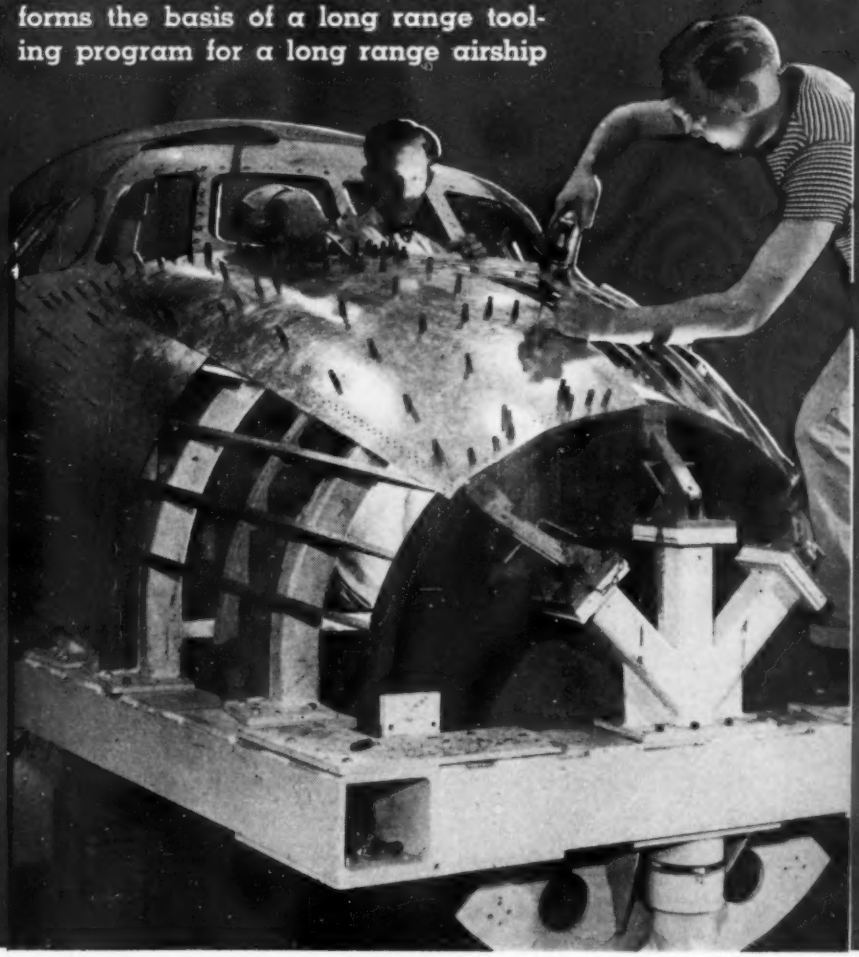
Armament

SECTION OF AMERICAN MACHINIST

Tooling Plays Stellar Role In Building the Constellation

By G. A. BETTS
Manager, Tool Engineering Department
Lockheed Aircraft Corporation

Advanced engineering technique, using built-up standard fixture elements, forms the basis of a long range tooling program for a long range airship



A Luxury Airliner Goes to War

When the *Constellation,* Lockheed's answer to the need for luxury air travel, was turned over to the U. S. Army a big step was made in military transportation. This ship was designed according to specifications of Transcontinental and Western Air, Inc. Originally it was to be a convertible sleeper plane with a modernistic sky room cocktail lounge. As adapted to Army use it will fly a light tank and its complement of troops across an ocean. It will cross the continent in less than nine hours, or fly to Honolulu in twelve.

Powered by four 2000-hp. Wright engines, the *Constellation* is built to fly above the weather. Its pressurized cabin, always air conditioned, will maintain the air density of the 8000 ft. level above 20,000 ft. and in case of need the *Constellation* can rise comfortably to 35,000 ft. It is faster than a Jap Zero or any four-engined bomber now in service.

Now reaching the stage of steady mass production, the *Constellation* will give the U. S. greater troop and supply carrying potentialities than any other nation on earth. It is fitting, therefore, that this ship should be the first to be manufactured on fixtures designed by Lockheed tool engineers according to the modern, coordinated plan described here.

TODAY'S TOOLING for airframe assembly is like the tall oak that grew from a little acorn. The acorn was the beginning—a simple wooden frame on which parts could be put together more conveniently. The oak is a coordinated system of fixture design, well exemplified by Lockheed's tooling for the *Constellation,* the new giant long-range cargo plane.

The first tool engineers in the industry were airplane designers who regarded manufacturing aids merely as a means to an end. Their first interest was in the theory of flight and in the principles of aircraft construction. Tooling was incidental — a necessary evil.

As manufacturing quantities increased, shop tools were improved, and eventually tool design was put into the hands of specialists—men whose first interest lay in tooling rather than in aircraft design. A recent development has been the coordination of aircraft engineering and tool engineering with a long range approach to the common problem of building good planes accurately and economically.

The first step in aircraft assembly fixtures after the wooden frame was to use standard structural steel shapes. These were usually angle iron, T sections and flat plate. No effort was made to calculate their strength or deflection; the steel shapes were selected entirely by rule of thumb and the resulting fixtures were as strong as the designer's best guess. When it was found that more rigidity was required, other commercial structural shapes were added including I-beams, channels and H-sections. More recently oil-well casing and drawn steel tubing, both round and rectangular, have become popular in certain plants.

Tool engineers at the Lockheed Aircraft Corporation have developed fundamental standards for assembly fixture design and construction; insofar as is practical, fixtures have been broken down into their elements. Standard sections have been designed and tabulated, together with such components as legs, brackets, clamps and locating pins. Detailed structural analyses have been made of the standard sections, and upon these findings, basic structural fixture types have been devised.

The primary thought has been to obtain a sound foundation on which to develop fixture design for major airframe assemblies. To do this it has been necessary to eliminate unknown elements in the finished fixture, which could not be done with rough surfaces or shimmed joints.

The advantages of this work are many. The rigidity of the finished structure is greatly increased. Since jig frames are engineered for deflection, weight is put into them where it will do the most good and reduced where not necessary. Studies have shown that many of the rule-of-thumb fixtures formerly used were extremely wasteful in that they used metal lavishly where it did not materially contribute to the strength of the finished structure. Knowing exactly what the problems are and how best to meet them has thus saved material as well as time.

Another contribution to precision has been the use of fixture frames with machined plane surfaces. In setting up locating points, the toolmaker has an opportunity to work from flat surfaces just as he would in locating the key points of a jig by working from a surface plate in the toolroom. This construction avoids complete dependence upon the use of transit, wire and plumb lines; it has been found that no two men will arrive at the same result using such devices.

Tool engineering has been greatly simplified, and consequently the design of any one jig has been greatly speeded up. The Lockheed tool design department is now turning out an average of eleven major fixture designs a day.

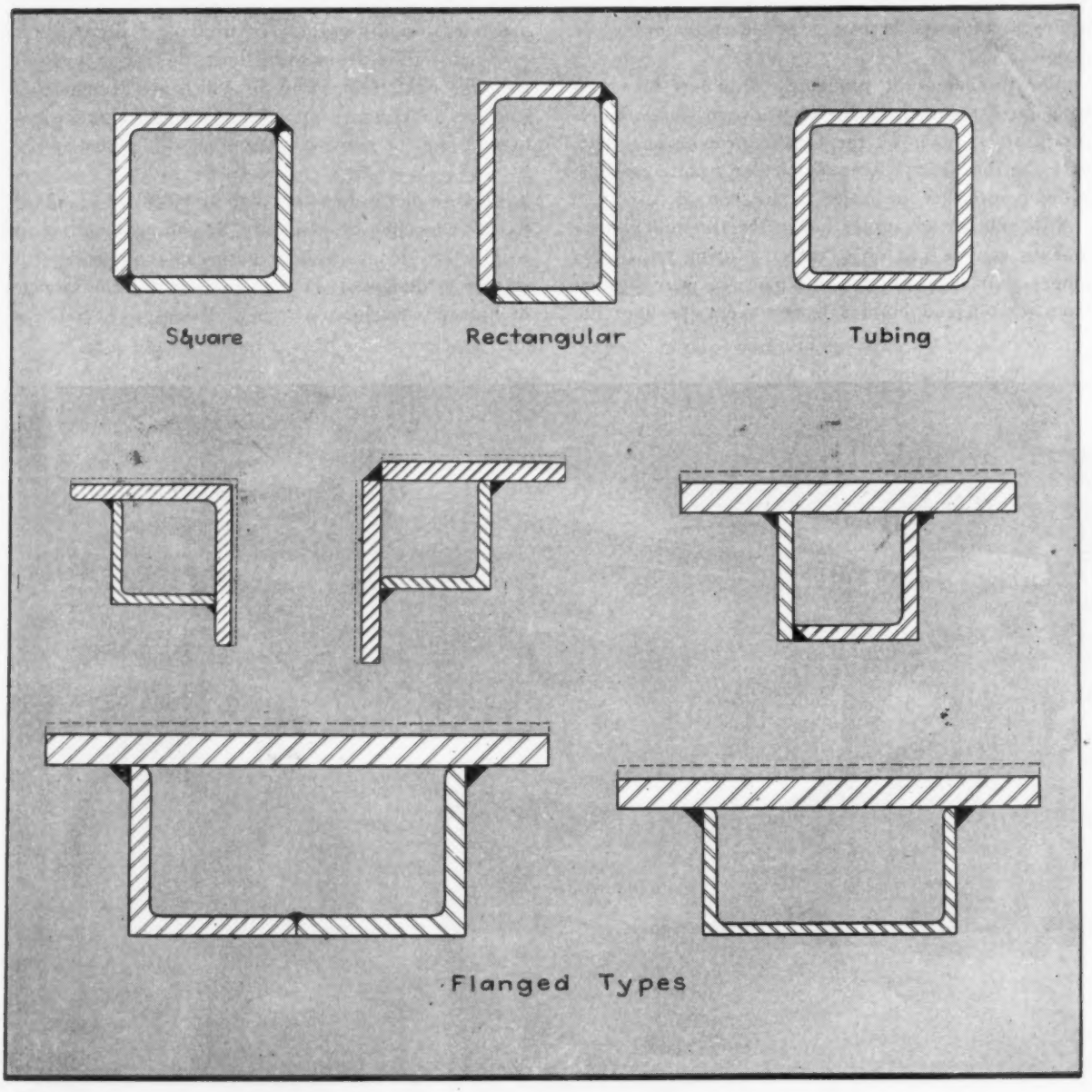
The mechanics of producing drawings has been accelerated through the use of prints of standard fixture frames, made by the Ozalid process, on which only the dimensions for a particular fixture need be added before they are issued to the shop.

Still another advantage lies in the fact that fixture making can be put on a manufacturing basis. No longer is it necessary for one gang of men to start from scratch and build a fixture from the floor up. Cutting the material and welded fabrication is done in one department. The sections thus formed are then sent out for stress relieving. Then they are machined, usually on planers, in another department.

When the fixture is to be built, the frame with all its component parts, many of which are drawn from stock, is delivered to the assembly floor, where a separate group of men specializes on this phase of the work.

Because of the fact that flat surfaces and standard fixture elements are employed, Lockheed's method of tool design lends itself to a great adaptability for change in design of the airplane and for the salvage of fixture parts for use in new designs. The jigs are

Airplane fixtures have evolved from early rule-of-thumb construction to well-engineered design. The one shown here is typical of practice five years ago. The fixture is massive, but the materials are not used efficiently. As a result the structure is not inherently rigid. It does not resist torsional and bending loads to the proper degree. Three in-line supports are attached to the floor for increased rigidity. This causes the fixture and airplane assembly to be influenced by floor movement and expansion between the steel structure and concrete. The net result is that parts obtained from this tool do not have tolerances within the limits desired

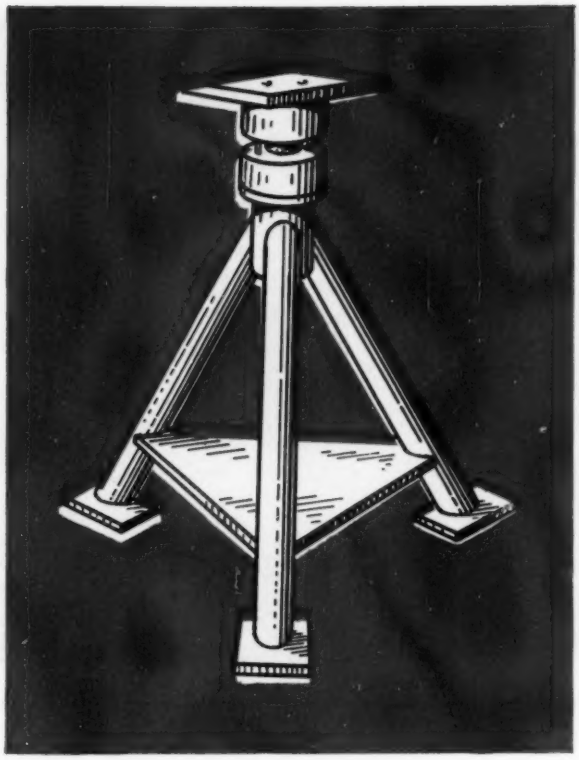


built in much the same way as a boy uses a toy "Meccanno" set. They can be altered or torn down without in any way impairing the usefulness of the parts for future work.

Lockheed has standardized on square or rectangular box sections for its fixture frames. This construction combines the advantages of a flat working surface with maximum rigidity. Because of its symmetrical form, this type of section resists loads uniformly in all directions. Rectangular forms have a torsional efficiency comparable to that of cylindrical shapes, such as tubing and casing.

The rectangular box sections are made from two steel angles, welded at diametrically opposite corners. All welds are ⅜-in. fillet or single V with a 2-in. minimum length based on 6-in. centers. This type of intermittent weld can be made in one pass of an electric arc and has been found to give the best combination of strength and manufacturing economy. Such box sections are made in a variety of sizes, both square and rectangular, with a few variations which use combinations of steel shapes to give extended flanges where such design seems advantageous. The structural characteristics of all such box sections have been computed; the standard drawings give the weight of the sections in pounds per foot, the cross-sectional area, the moment of inertia about each neutral axis and the location of each axis.

Standard engineering methods are used to compute the beam characteristics of these sections for the span in which they are to be used. Calculations differ, however, from the usual structural analyses

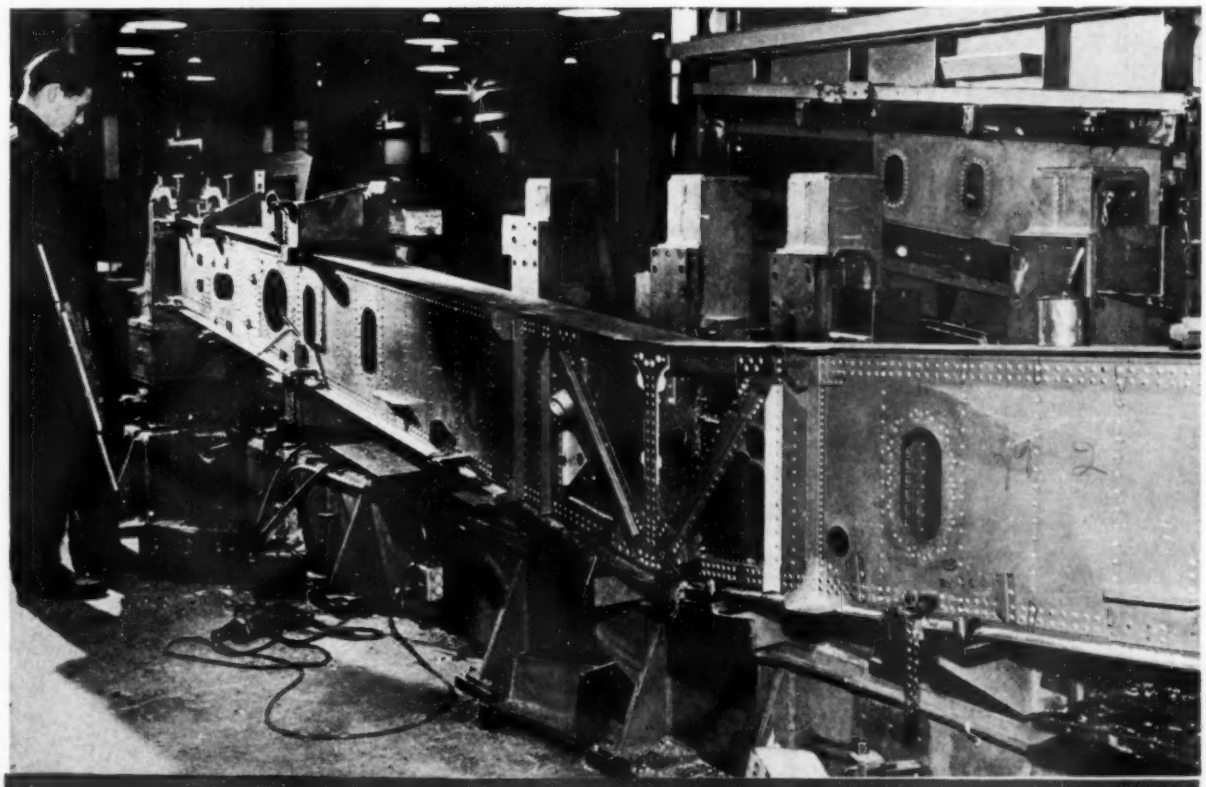


Standard tripods supply single-point floating support on many of the three-point suspension fixtures

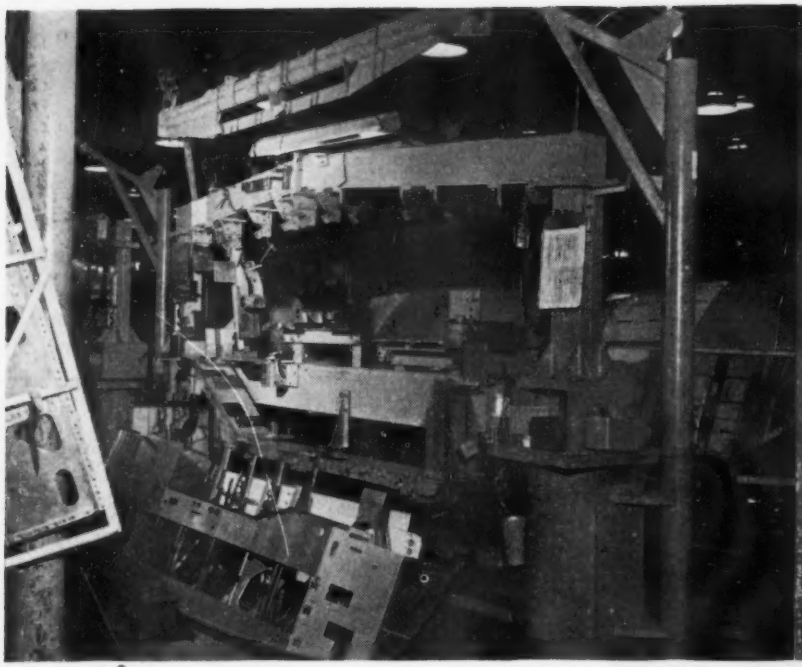
in that deflection rather than strength is the deciding factor in determining the size of section to be used.

A subject that has required more research has been the design of the connecting members in the fixture frame. In early designs, a flange on one box section was bolted directly to the side of another. An analysis of such tension joints showed that they often had only ten percent of the strength of the frame. In addition they had little resistance to a load that would cause the frame to "domino," that is, distort from a rectangular to a diamond-shaped structure.

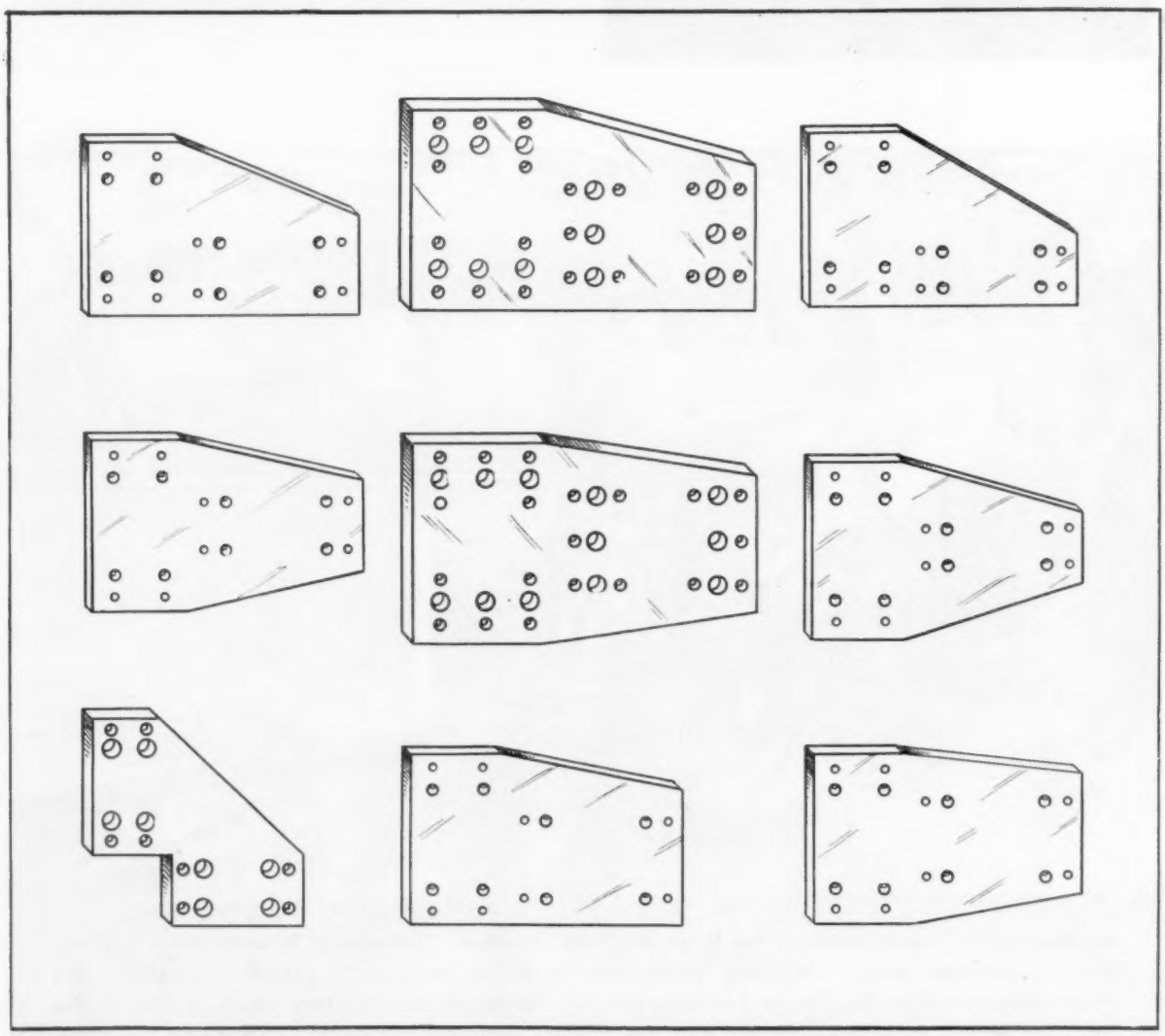
The standard joint plates now used by Lockheed have within five percent of the strength of the box section and are designed to give maximum rigidity. They are held to the box section by means of bolts and dowel pins. Uniform pin patterns have been devised which give a joint of equal strength in both the connected members. Each plate has been analyzed; the standard drawings show the allowable bending moment, the bearing load and the shear load. All bolt and pin holes in the plates are pre-drilled



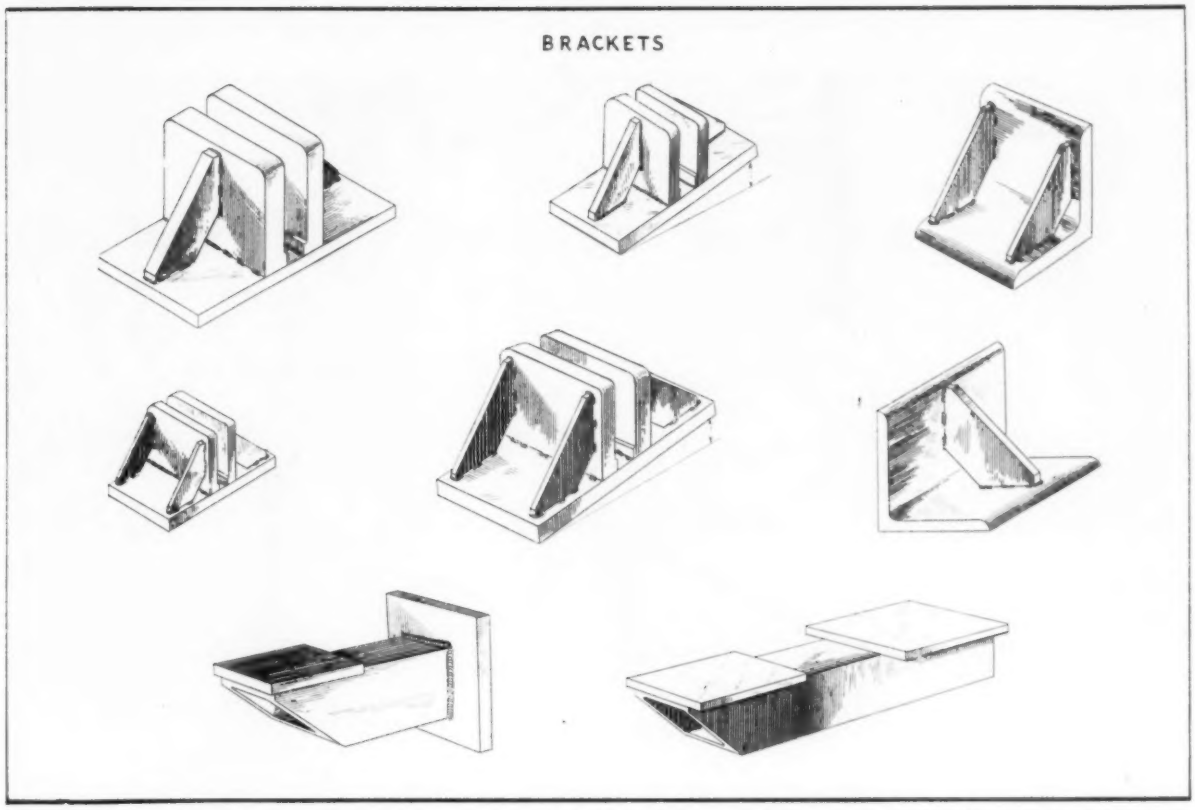
Another type of main beam jig has large structural members. Clearance between them and the airplane part are small. Therefore, accessibility to the airplane part is greatly diminished. The structural members of this jig are far too strong for the purposes which they serve. However, the joints are weak. As a result the tool does not produce parts with tolerances within the limits desired. This fixture is attached to the floor at 16 points, which is poor practice



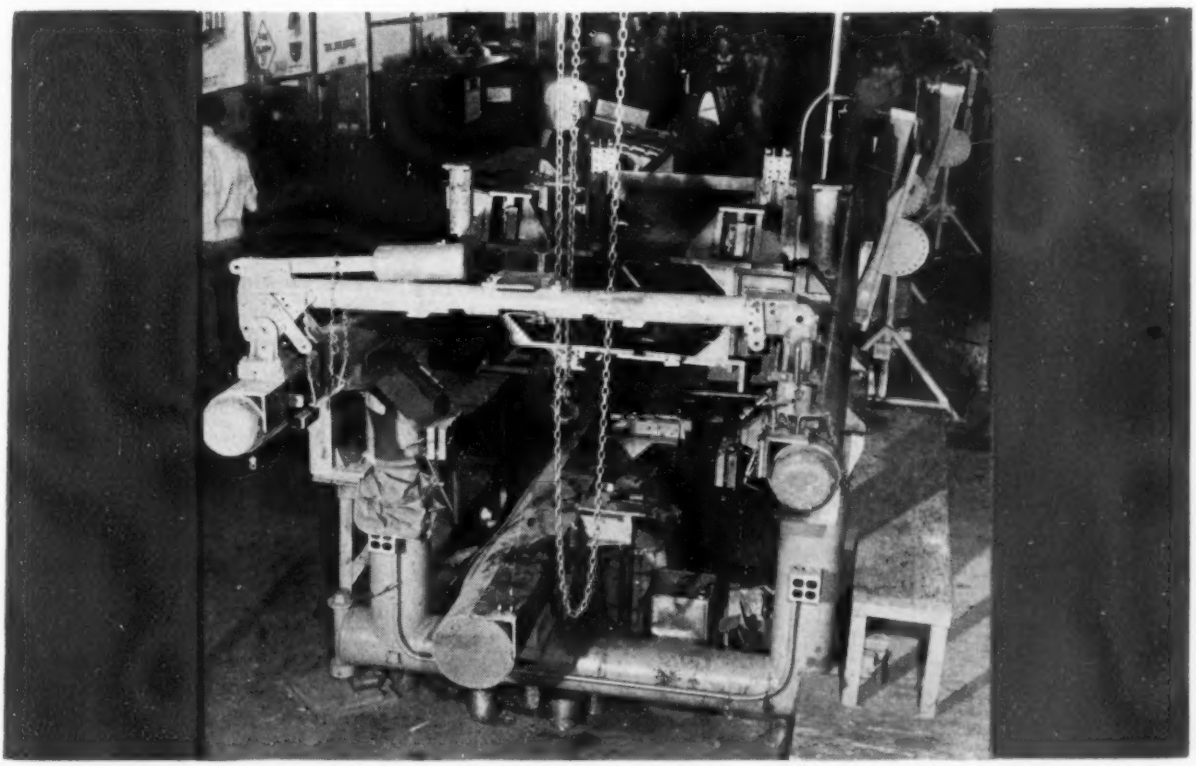
This jig is fabricated from box beams made by welding commercial channel sections together. All joints are of the butt type. They are weak in comparison to the strength of the heavy box section. The supports are extremely heavy for the weight of the jig. An assembly fabricated in this fixture lies below it



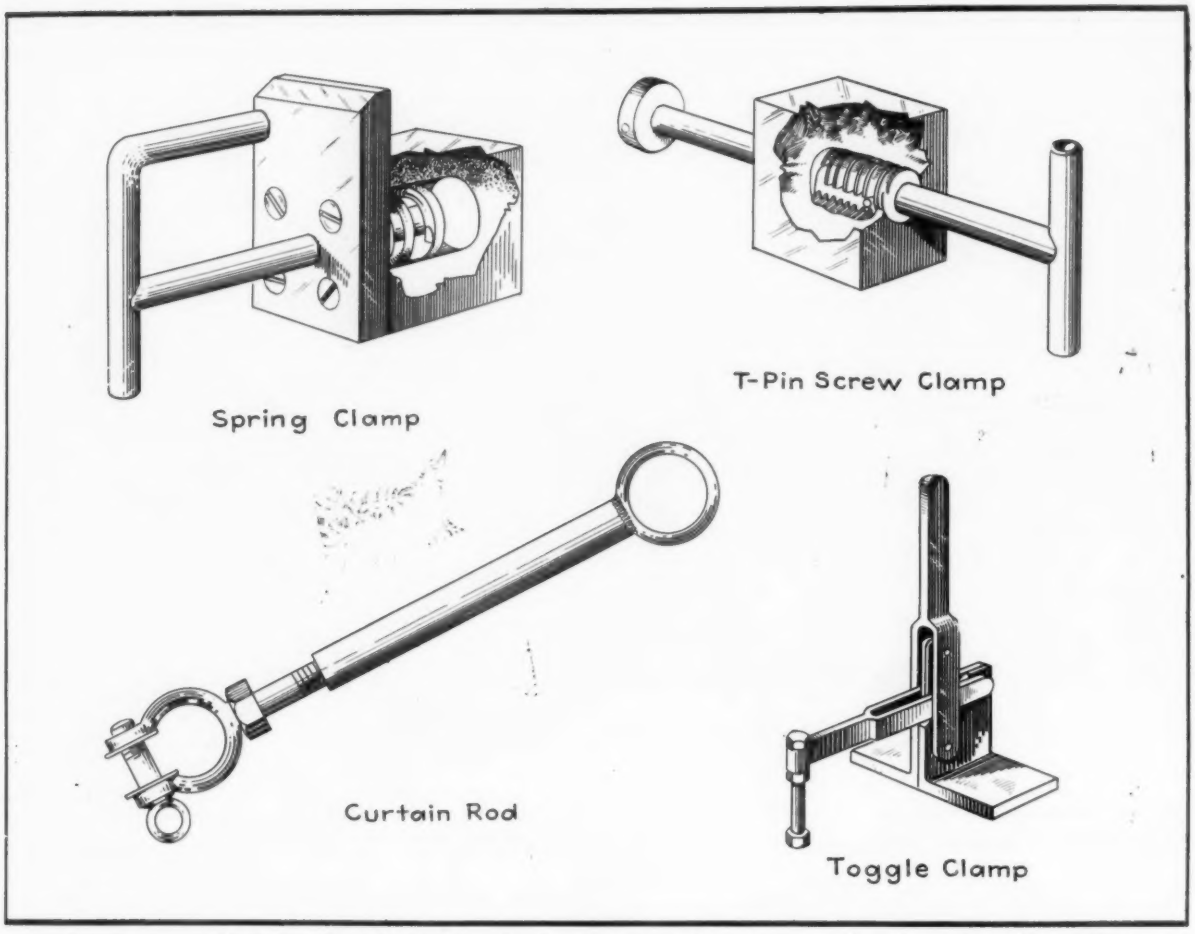
Joint plates are a vital part of fixture design as they make the joints of comparable strength to the box beams. Poorly designed joints are the weak points in many aircraft fixtures



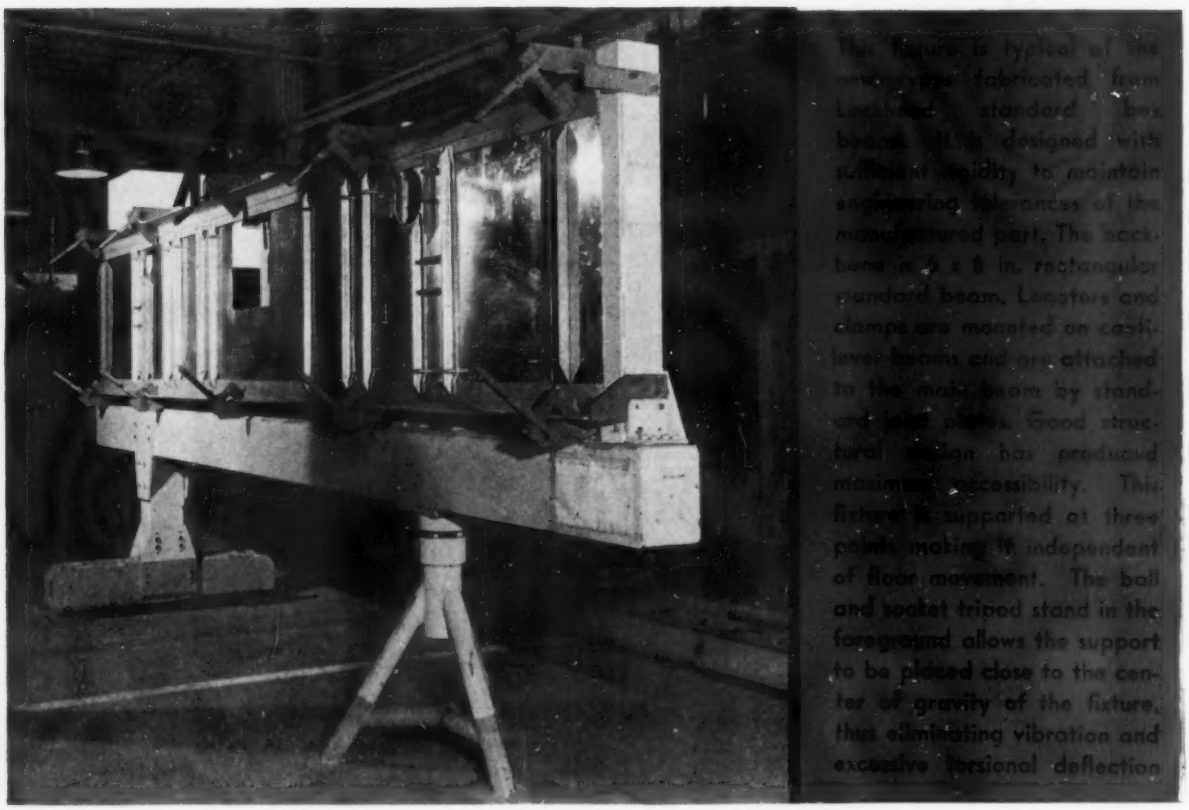
Various types of brackets and bracket arms are fabricated from welded steel plate. Standard designs are followed



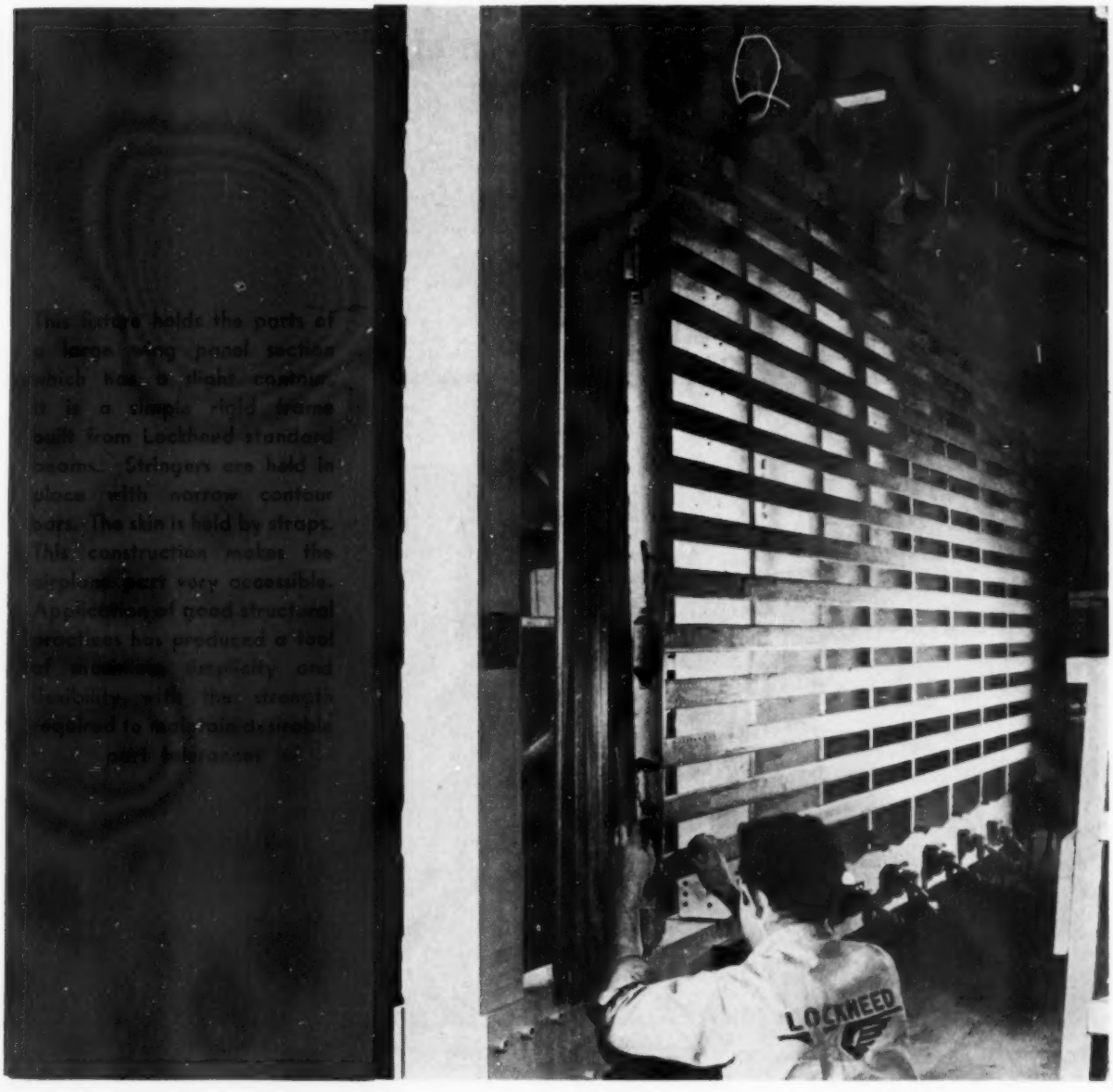
This fixture is typical of mixed construction. Casing, structural angles and channels were used to produce a frame that is inherently rigid and produces parts to the tolerances desired. Structural members are generally over-strength and over-size resulting in diminished accessibility to the airplane part. This fixture has three points of support; two in the foreground and one at the far end



Clamps are included in Lockheed's standards. Here are three types and a "curtain-rod" support



This fixture is typical of the many types fabricated from Lockheed's standard box beams. All are designed with sufficient rigidity to maintain engineering tolerances of the manufactured part. The section here is a 6 x 8 in. rectangular standard beam. Locators and clamps are mounted on cantilever booms and are attached to the main beam by standard joint plates. Good structural design has produced maximum accessibility. This fixture is supported at three points, making it independent of floor movement. The ball and socket tripod stand in the foreground allows the support to be placed close to the center of gravity of the fixture, thus eliminating vibration and excessive torsional deflection


This fixture holds the parts of a large wing panel section which has a slight contour. It is a simple rigid frame built from Lockheed standard beams. Stringers are held in place with narrow contour bars. The skin is held by straps. This construction makes the component very accessible. Application of good structural practices has produced a tool of economy, simplicity and rigidity, with the strength required to maintain desirable part tolerances.
LOCKHEED

in jigs but the dowel pin holes are reamed in place when the fixture is being assembled.

In order to check the structural analyses of both box sections and joint plates, experiments have been conducted to determine their deflection under load. Hydraulic jacks operated by a hand pump supply the loads while deflection is measured by dial indicators reading to 0.0001 in. Gages are calibrated to read directly in pounds pressure applied at the ram head.

Box beams are tested singly and in built-up structures. Joints are loaded for linear distortion, bending and torsion. Independent experiments have been run on various sizes of dowel pins to find their allowable shear and bearing loads.

Thus the fixture elements are proved to check the accuracy of the engineering calculations.

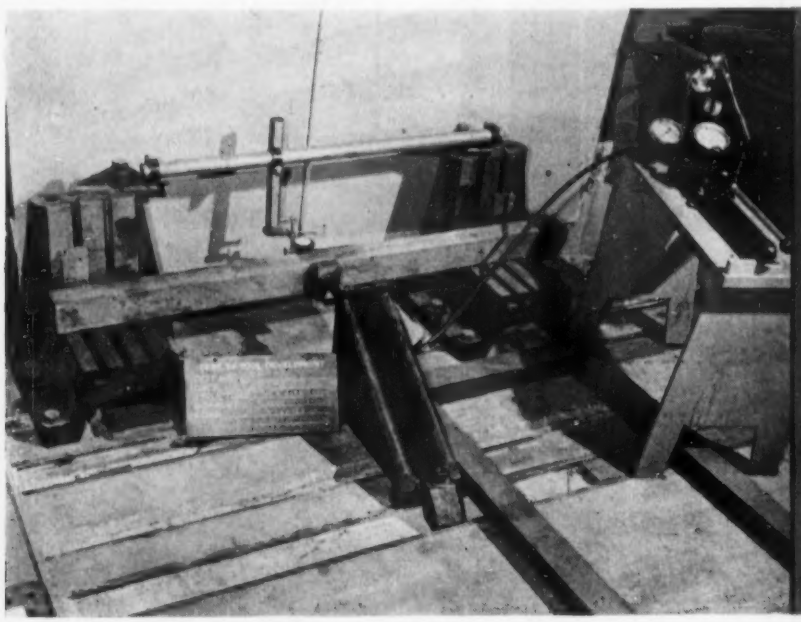
From the standard basic box section, joint plates and other elements, eight basic single-plane space frames have been formulated. These are:

"Picture" frame with four-point support.
"Picture" frame with three-point support.
Single beam for short fixtures.
Box beam with gussets and a trunnion stand.
Rectangular welded box beam with trunnion stand.
Tapered welded box beam with trunnion stand.
Single beam for long fixtures.
Single beam with trunnion stand.

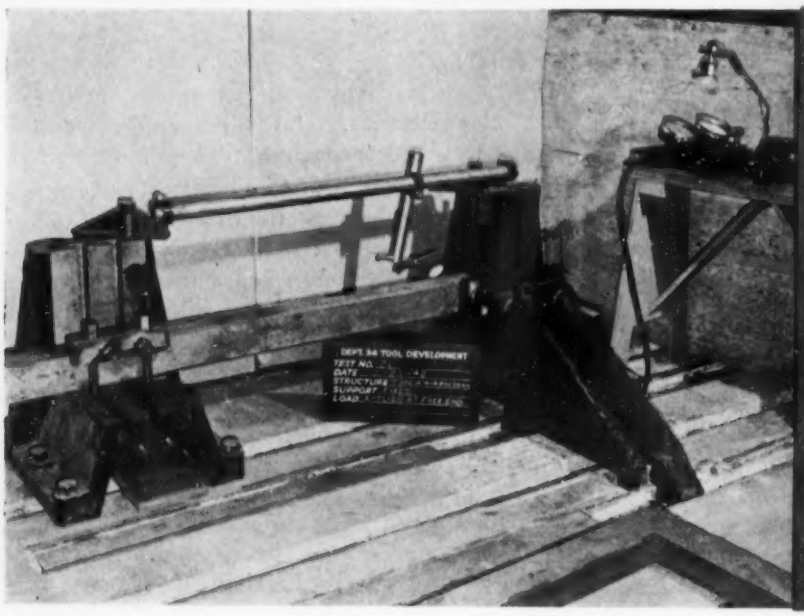
All Lockheed trunnion stands have a universal ball joint so that any settling of the support cannot deflect the fixture frame. In fact, all fixtures are designed to be independent of the floor surface. They are self-supporting and can be moved at any time without affecting their accuracy.

Typical Tests on the Deflection of Fixture Members

Tests have been made by Lockheed engineers on fixture elements to remove all guesswork from aircraft tooling. While loads are applied in a variety of ways, the general procedure is the same. The structural member or assembly is held against a strongback while the load is applied by means of a hand pump and hydraulic jack. Usually a half section of a spherical ball is used to transmit the load from the jack to the beam to avoid twisting. Pressure gages on the pump give the load on the beam. Deflections are measured by means of dial indicators, reading in 0.0001 in., attached to the anchors. A few of the many tests are shown here to indicate the thoroughness of the analysis.

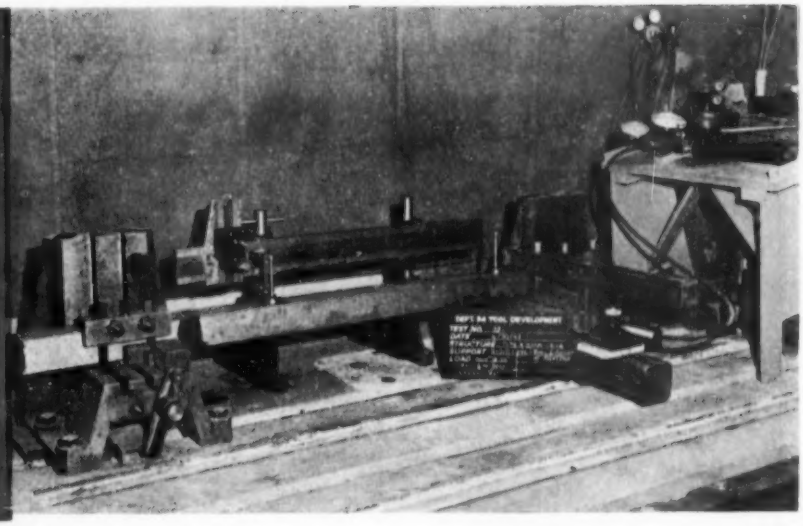


Bar Beam. The supports are ground round bars set in semi-circular grooves. The load is applied to the center of the span while deflection is measured at a point opposite the load application

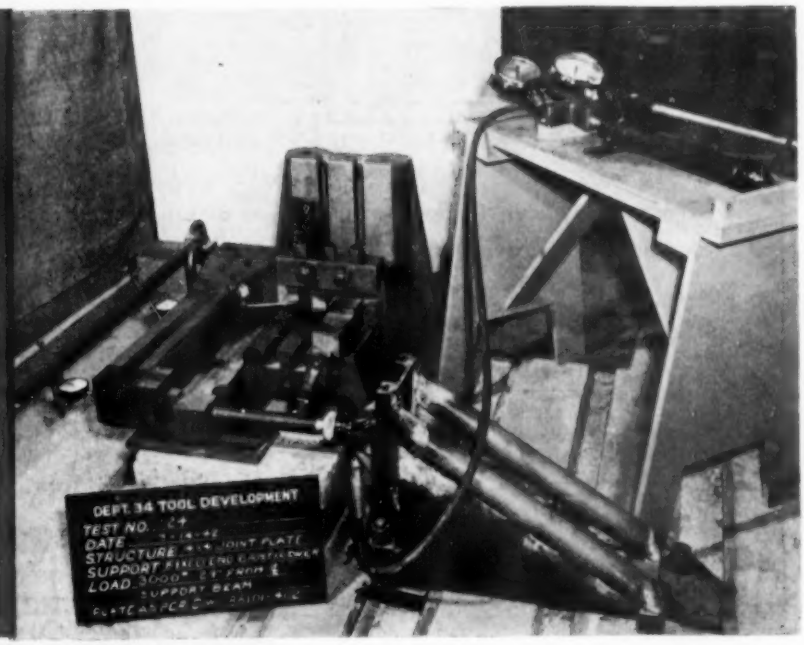


Cantilever. The fixed end of a rectangular box section is held by clamping an angle block to the anchor in two directions. The load is applied to the free end and deflection is measured opposite it. At the beginning of the test an indicator is used to check any motion of the beam at the fixed end

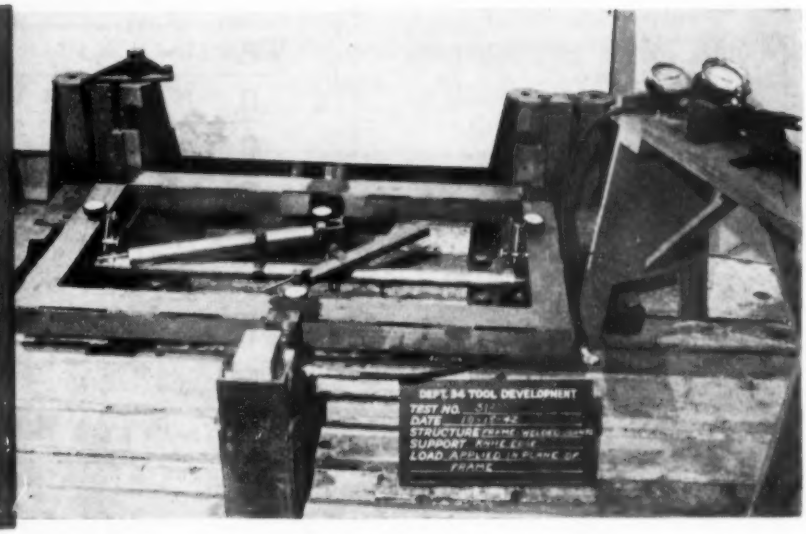
Torsion. One end of a square box beam is fixed while the other it twisted without bending. Two ball standards are placed on top of the beam a measured distance apart to gage the movement. The dial indicators are mounted on a comparator behind the beam. One of the two pressure gages on the pump measures loads up to 1800 lb., the other up to 14,000 lb.

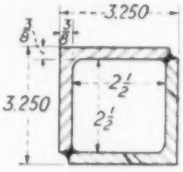


Joint plates. A 4 × 4-in. cantilever post is attached to a 4 × 4-in. beam by means of two joint plates. The standard joint plates now used at Lockheed are modifications of these. The jack load is applied through a ball joint parallel to the plates. Dial indicators measure deflections of the beam and movement of the plates.

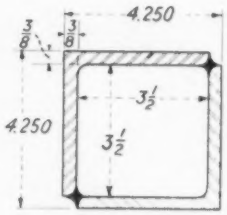


Welded Joints. A frame is loaded at the midpoint of the long side with knife-edge supports in line with the center line of the columns. Deflection of the front and rear beams is taken by the two center indicators. Bending of the columns is measured by placing indicators against their midpoints.





A



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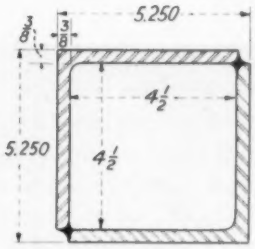

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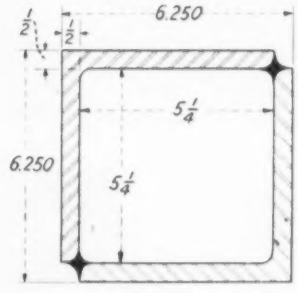

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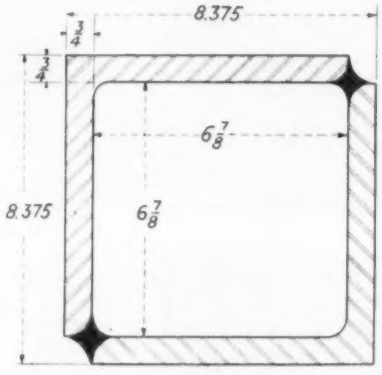
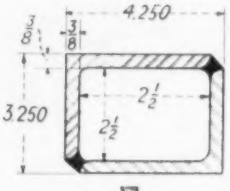


E

These are typical standard cross sections of square and rectangular fixture beams. All welds are ⅜ in. fillet or single V



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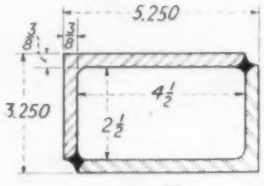
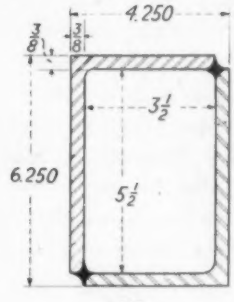


G



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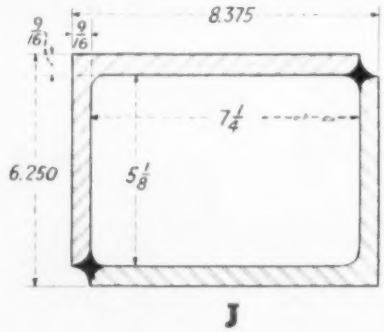
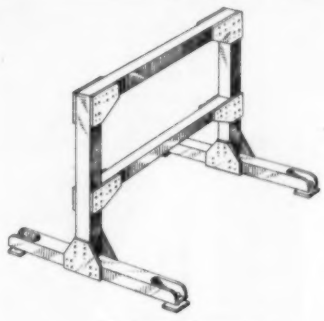


J

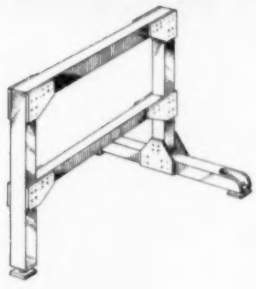
Note:
1. All welds ⅜ fillet or single V unless otherwise noted. Use 2 inch minimum intermittent welds 6 inches between centers.
2. Normalize before machining

SECTION PROPERTIES

	Lb./Ft.	Area In²	Ix In⁴	Iy In⁴	X In	Y In
A	13.7	4.04	6.1	6.1	1.625	1.625
B	18.9	5.54	14.4	14.4	2.125	2.125
C	23.8	7.02	29.2	29.2	2.625	2.625
D	37.4	11.00	62.5	62.5	3.125	3.125
E	75.0	22.12	225.0	225.0	4.188	4.188
F	16.3	4.78	11.9	7.5	1.625	2.125
G	18.8	5.52	20.2	9.2	1.625	2.625
H	23.8	7.02	37.6	21.0	2.125	3.125
J	50.0	14.7	140.0	88.0	3.125	4.188



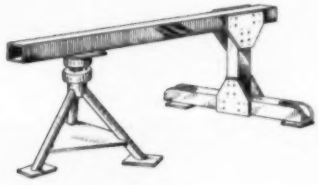
Picture Frame
4-Point Support



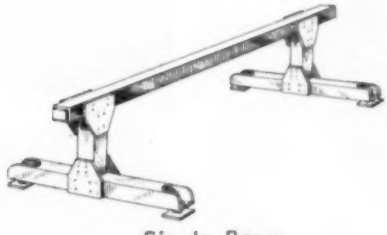
Picture Frame
3-Point Support

Box Beam
Gussets and
Trunnion Stand

Welded Box Beam
and Trunnion Stand



Single Beam
Long Fixture



Single Beam
Short Fixture

Single Beam
Trunnion Stand

Tapered Welded
Box Beam
Trunnion Stand

The more common types of fixture frames have been standardized so they may be used without further design. Special types must be laid out but they, too, consist largely of standard elements

A standard tripod, used on jigs having three-point support, is fitted with a ball and socket joint which again makes it independent of any irregularity or settling of the floor.

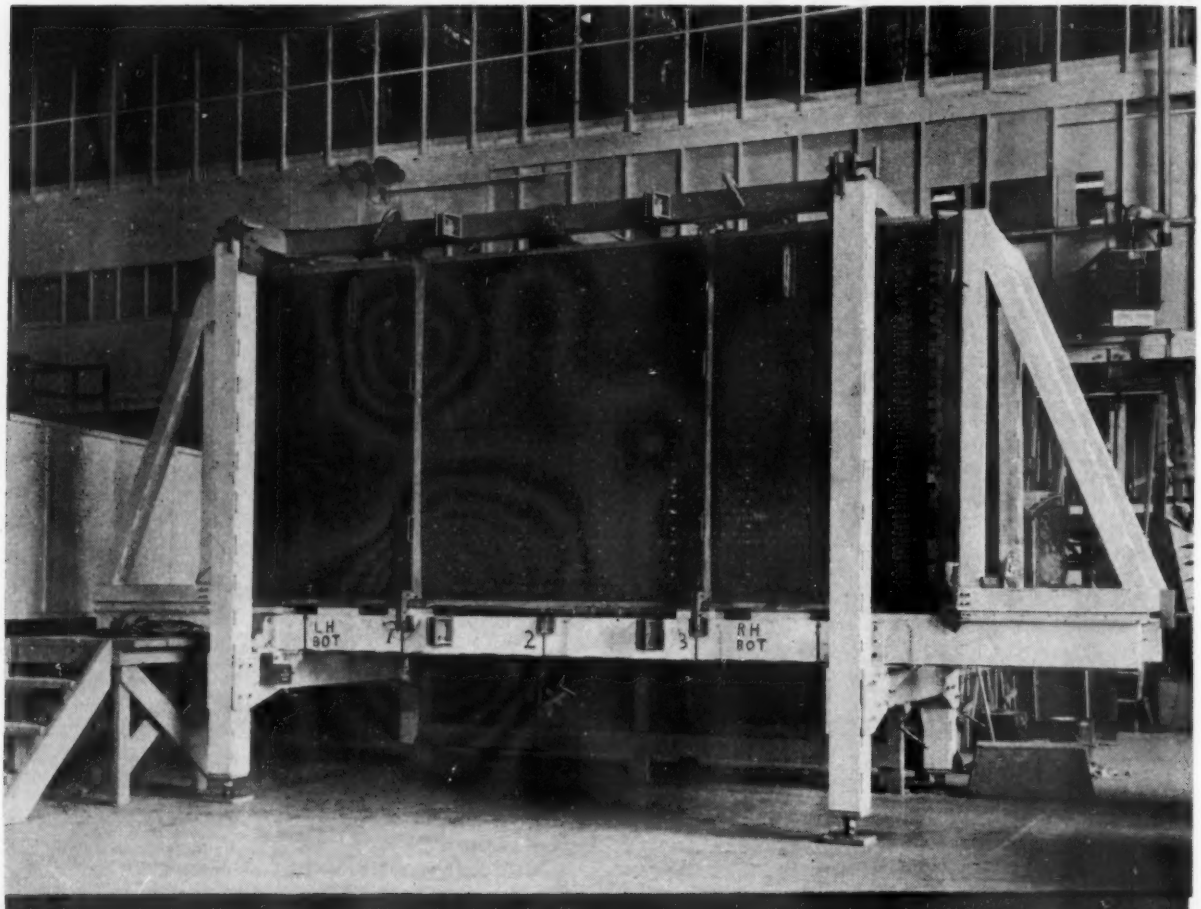
Standard legs are made in box sections, cut away at the ends to receive floor bolts.

Spring, screw and toggle clamps are provided in a range of standard sizes so the designer can select whichever suits his purpose best. Brackets for holding locating points are available in a variety of standard shapes and sizes.

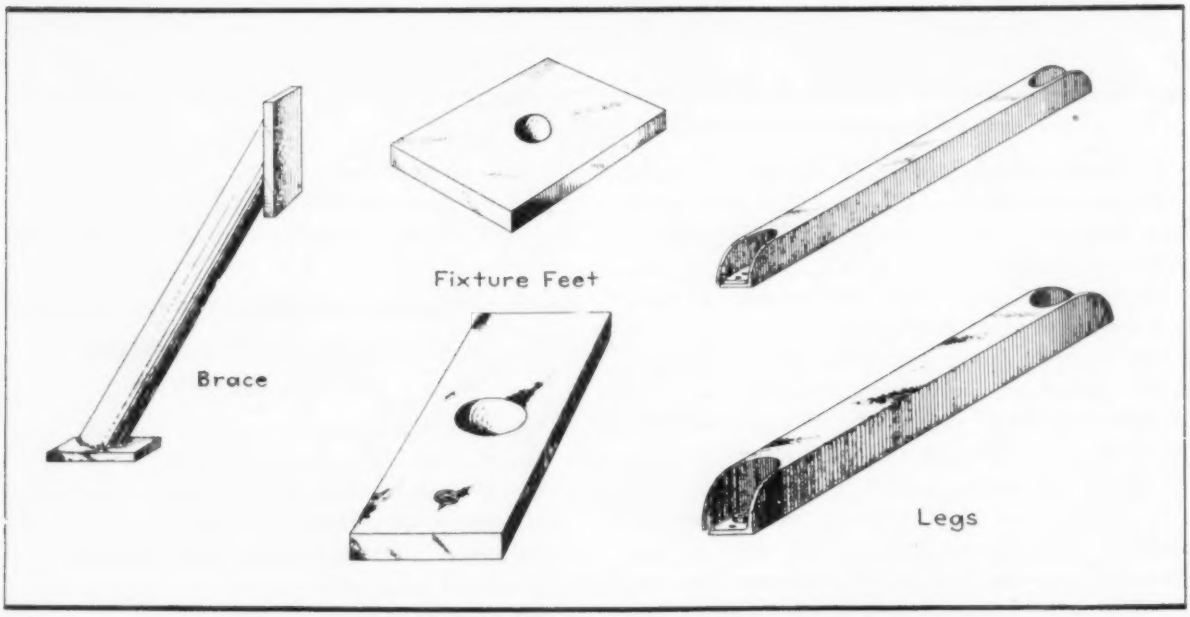
In working out these standard fixture elements, Lockheed tool engineers have realized that they cannot take care of every part of every fixture. However, in all primary fixture structures, the standard box sections have provided a basis for design that will take care of 90 percent of their requirements. Where special members are needed they are designed and analyzed for the particular purpose to which they are put.

ADVANTAGES OF STANDARD FIXTURE ELEMENTS

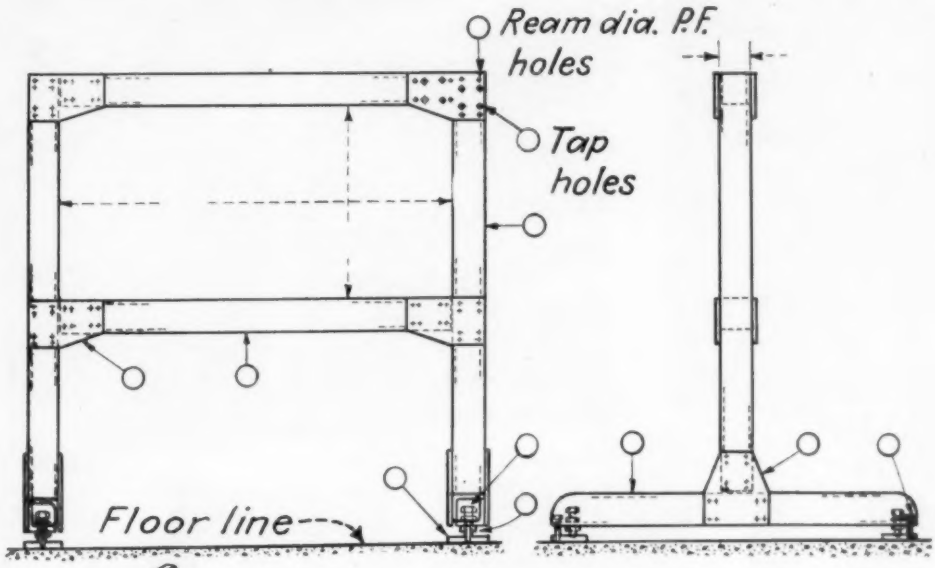
Speed in tool design
Greater rigidity in finished fixture
Manufacturing methods on fixture elements
Elimination of unknown variables
Toolmaker methods in fixing locating points
Increased accessibility
Economy of materials

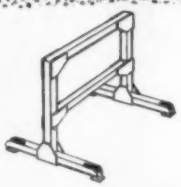


This jig fabricates a section of a large wing. The end frames are retractable to compensate for temperature changes and to allow removal of the part. The top frame is detached from the fixture before removing the part. Because of its size and weight this fixture is mounted on four points. This method is satisfactory since the structural design of the tool is inherently rigid. The fixture always maintains desirable tolerances and coordination in the manufactured part

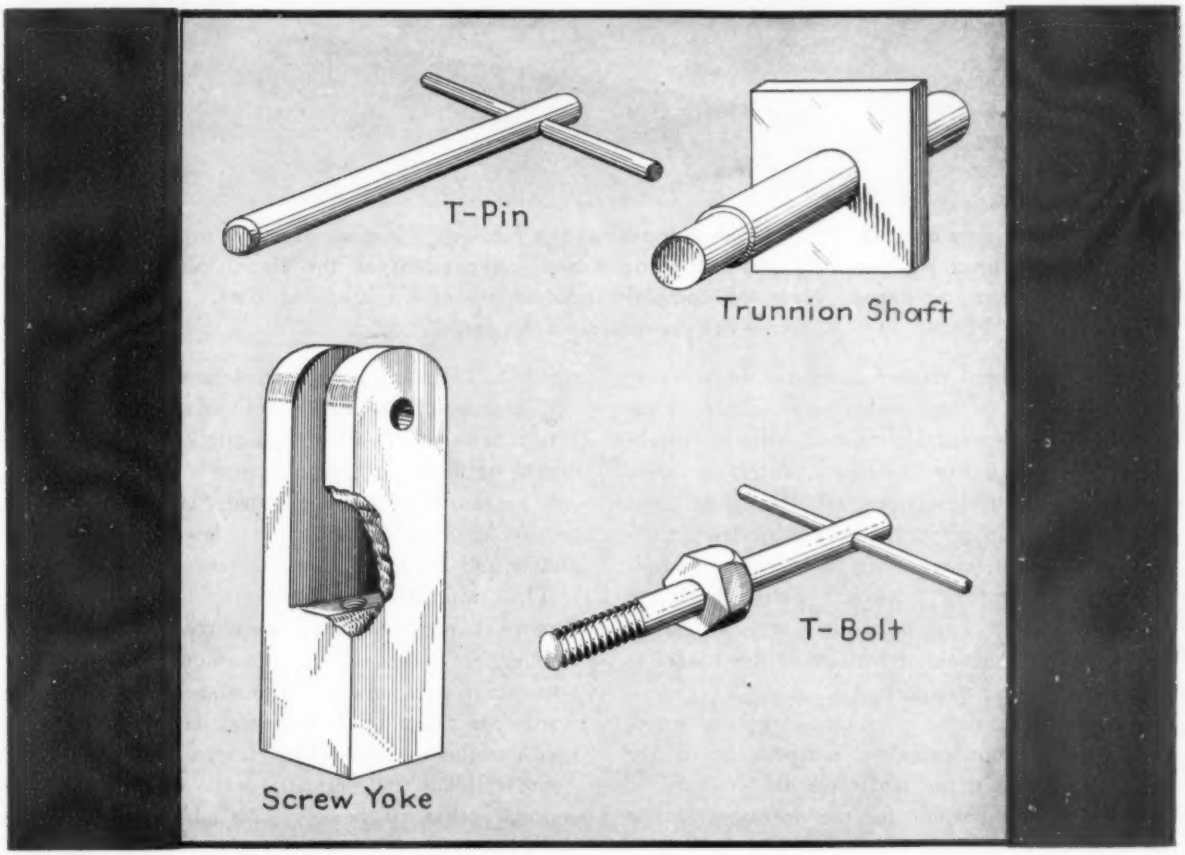


Legs, feet support members and braces are part of the tool standards program

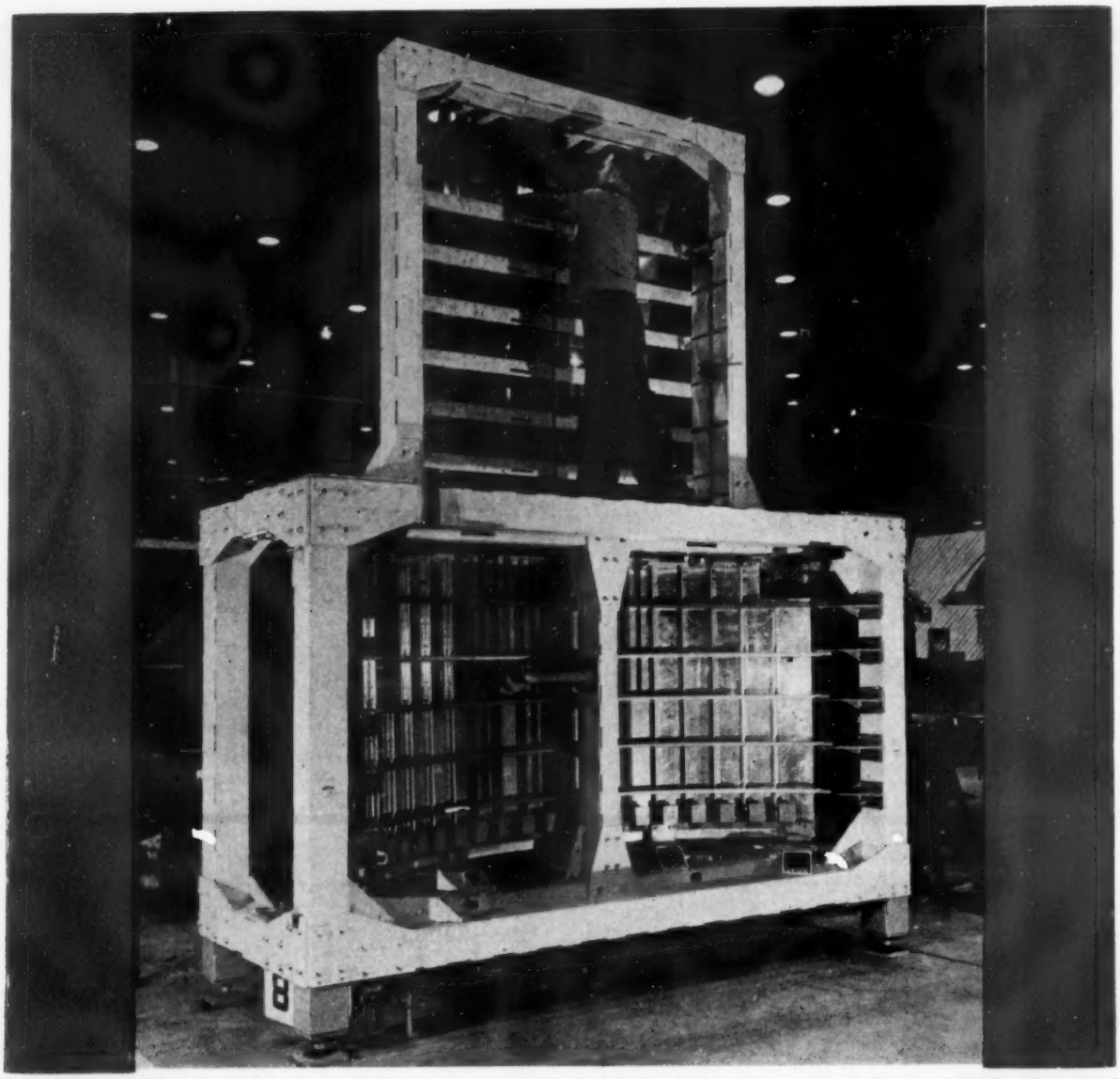




Tool designs are speeded through the use of standard manufacturing sheets. For simple "picture frame" fixtures such as this it is necessary only to add overall dimensions and detail numbers



Other fixture details, such as those illustrated above, are also made the predetermined dimensions



This fixture holds the parts for a large curved panel of the fuselage. It is an excellent example of typical construction now used by Lockheed. Inherently rigid and independent of the floor, this tool produces parts to the desired tolerances. Note the complete accessibility of the airplane part. Working stands are not shown around this fixture

Likewise, Lockheed fixture designers do not permit themselves to become slaves to a system. They seek the proper structural section to solve the problem in question. For example, on large jigs, commercial structural sections are frequently used for supporting members as they are subjected primarily to compression, eliminating the need for consideration of bending or torsion. Standard frame cross-sections have a limit of about 8 × 8 in. Above these outside dimensions resort must be made to truss construction or special beams.

Work platforms, now constructed largely of wood, are built with floor supports, independent of the fixture. In addition, the platforms are designed so it is difficult or impossible for the operators to rest their weight on the fixture frames. The purpose is to avoid unnecessary and unpredictable loading which would create unknown deflections.

The result of the method of fixture design described here is a well-balanced system of tooling with a high degree of flexibility. Any fixture made in this way can be shortened or lengthened. If at any time a fixture becomes obsolete, it can be torn down completely and the standard parts returned to stock.

Thus, aircraft assembly tooling has come of age. Empirical methods have been replaced by sound engineering considerations. Economy of material, fabrication and increased precision are adequate rewards for the careful planning that has put Lockheed's method of fixture design into actual operation.

So well has the method worked out on the *Constellation,* that it is being rapidly adapted in retooling the *Lightning* (P38), Lockheed's world-famed interceptor.

Machining Allowances for Seamless Tubing—I

As an addition to its "Steel Products Manual," the American Iron and Steel Institute has issued the following material under the title "Standard Machining Allowances for Seamless Steel Tubing for Aircraft Shock Struts and Landing Gear."

FOREWORD

Mechanical tubing is produced with one or the other of two common finishes: hot finish and cold drawn finish. There are two basic methods employed in machining steel tubing: (1) by machining true to the outside diameter of the tube; and, (2) by machining true to the inside diameter of the tube. Four variations in machining allowances plus camber allowance result.

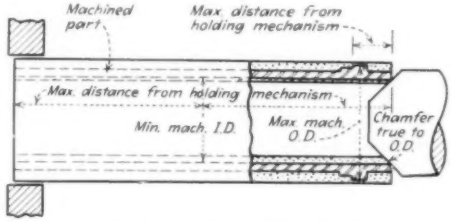
CAMBER ALLOWANCE

When the machined dimension used in calculating extends more than 3 in. from the chuck or other holding mechanism, the possibility that the tube will be out-of-straight or *cambered* must be taken into consideration.

In such cases the following camber allowance must be added to the machining allowance for O.D. or I.D., or both, as required.

Distance from chuck of machined dimensions used in calculating, in.	Allowance on O.D. of machined part, in. To 5 in. incl.	Over 5 in.
Over 3 to 6, incl.	0.010	0.020
Over 6 to 9, incl.	0.020	0.030
Over 9 to 12, incl.	0.030	0.045
Over 12 to 18, incl.	0.040	0.060
Over 18 to 24, incl.	0.050	0.075
Over 24 to 30, incl.	0.060	0.090
Over 30 to 36, incl.	0.070	0.100

The sketch illustrates the method used in determining the "distance from chuck" of the machined dimension used in calculating. In the case of irregular machined sections the overall length of the tube does not necessarily determine the camber allowance.



Cold Drawn Tubing Machined True to O.D.

MACHINING ALLOWANCES

For machined parts Size, O.D., inches*	Machining allowances on diameter, inch O.D.	I.D.**
To but not incl. 1½	0.070	0.070
1½ to but not incl. 2½	0.075	0.075
2½ to but not incl. 3½	0.085	0.085
3½ to but not incl. 4½	0.095	0.095
4½ to but not incl. 5½	0.105	0.105
5½ to but not incl. 6½	0.120	0.120
6½ to but not incl. 8	0.135	0.135
8 to but not incl. 10¾	0.150	0.150

* In calculating, use the maximum machined O.D. and the minimum machined I.D. if machining tolerances are given. If only one machined dimension is given for each diameter, asume them to be the maximum machined O.D. and the minimum machined I.D.

** Allowance for wall variation is additional.

Standard tolerances for mechanical tubing apply as shown in Table 5 of "Steel Products Manual," Section 18 covering Steel Tubular Products. When an *under* tolerance is shown on the O.D. this amount must be added to the O.D. machining allowance shown above to assure proper stock removal.

Camber allowances as given herewith must also be added whenever applicable.

CENTERLESS GRINDING

If O.D. stock is to be removed by centerless grinding instead of machining, reduce all O.D. machining allowances by 0.005 in.

EXAMPLE OF CALCULATION

Cold drawn tube—machined true to O.D.

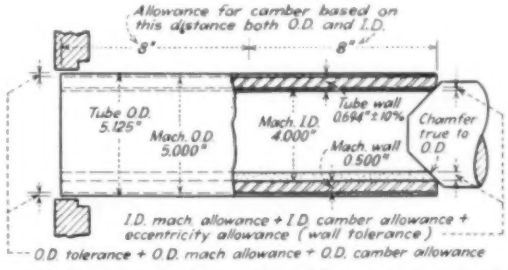
Problem: To calculate a tube size to machine to a straight cylinder 5 in. O.D. x 4 in. I.D. x 16 in. long.

Machined O.D.	5.000
O.D. machining allowance, *add*	0.105
Camber allowance, *add*	0.020
Tube O.D.	5.125
Machined I.D.	4.000
I.D. machining allowance, *subtract*	0.105
Camber allowance, *subtract*	0.020
	3.875

O.D. 5.125 — 3.875 = 1.250 = twice minimum wall thickness
Minimum wall thickness to assure required removal of stock = 1.250 ÷ 2 = 0.625

Wall thickness may vary ± 10% (Table 5, "Steel Products Manual," Section 18). Therefore, normal tube wall is 0.625 ÷ 0.9 = 0.694

Tube size to be specified: Cold drawn O.D.: 5.125 (+ 0.015, — 0.000)
Wall: 0.694 ± 10%


Allowance for camber based on this distance both O.D. and I.D.
8"
8"
Tube O.D. 5.125"
Mach. O.D. 5.000"
Mach. I.D. 4.000"
Tube wall 0.694" ± 10%
Mach. wall 0.500"
Chamfer true to O.D.
I.D. mach. allowance + I.D. camber allowance + eccentricity allowance (wall tolerance)
O.D. tolerance + O.D. mach. allowance + O.D. camber allowance

Cold Drawn Tubing Machined True to I.D.

MACHINING ALLOWANCES

For machined parts Size, O.D., inches*	Machining allowances on diameter, inch O.D.**	I.D.
To but not incl. 1½	0.070	0.070
1½ to but not incl. 2½	0.075	0.075
2½ to but not incl. 3½	0.085	0.085
3½ to but not incl. 4½	0.095	0.095
4½ to but not incl. 5½	0.105	0.105
5½ to but not incl. 6½	0.120	0.120
6½ to but not incl. 8	0.135	0.135
8 to but not incl. 10¾	0.150	0.150

* In calculating, use the maximum machined O.D. and the minimum machined I.D. if machining tolerances are given. If only one machined dimension is given for each diameter, assume them to be the maximum machined O.D. and the minimum machined I.D.

** Allowance for wall variation is additional.

Standard tolerances for mechanical tubing apply as shown in Table 5 of "Steel Products Manual," Section 18 covering Steel Tubular Products. When an *over* tolerance is shown on the I.D. this amount must be added to the I.D. machining allowance shown above to assure proper stock removal.

Camber allowances must also be added whenever applicable.

EXAMPLE OF CALCULATION

Cold drawn tube—machined true to I.D.

Problem: To calculate a tube size to machine to a straight cylinder 5 in. O.D. x 4 in. I.D. x 16 in. long.

Machined I.D.	4.000
I.D. machining allowance, *subtract*	0.105
Camber allowance, *subtract*	0.020
I.D. *over* tolerance, *subtract*	0.005
Tube I.D.	3.870

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Set No. 38 B—$155.00

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In selecting gage blocks buy from a recognized, established concern—Webber is the largest exclusive manufacturer of precision gage blocks in the United States.

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Machining Allowances for Seamless Tubing—II

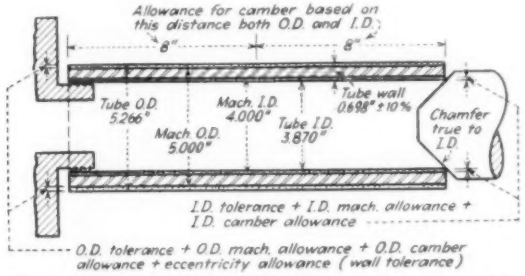
Machined O.D.	5.000
O.D. machining allowance, *add*	0.105
Camber allowance, *add*	0.020
	5.125

5.125 — I.D. 3.870 = 1.255 = twice minimum wall thickness
Minimum wall thickness to assure required removal of stock = 1.255 ÷ 2 = 0.628

Wall thickness may vary ± 10% (Table 5, "Steel Products Manual," Section 18). Therefore, normal tube wall is 0.628 ÷ 0.9 = 0.698

To obtain tube O.D.:	0.698 × 2 = 1.396
plus tube I.D.	3.870
	5.266

Tube size to be specified: Cold drawn O.D.: 5.266 (+ 0.015, — 0.000)
I.D.: 3.870 (+0.005,—0.015)


Allowance for camber based on this distance both O.D. and I.D.
8"
8"
Tube O.D. 5.266"
Mach. I.D. 4.000"
Tube wall 0.698" ±10%
Chamfer true to I.D.
Mach. O.D. 5.000"
Tube I.D. 3.870"
I.D. tolerance + I.D. mach. allowance + I.D. camber allowance
O.D. tolerance + O.D. mach. allowance + O.D. camber allowance + eccentricity allowance (wall tolerance)

Hot Finish Tubing Machined True to O.D.

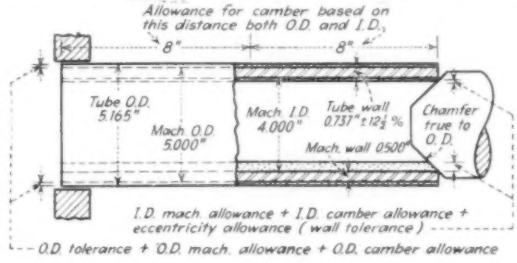
MACHINING ALLOWANCES

For machined parts Size, O.D., inches*	Machining allowances on diameter, inch O.D.	I.D.**
To but not incl. 2½	0.110	0.075
2½ to but not incl. 3½	0.125	0.085
3½ to but not incl. 4½	0.135	0.095
4½ to but not incl. 5½	0.145	0.105
5½ to but not incl. 6½	0.175	0.120
6½ to but not incl. 8	0.195	0.135
8 to but not incl. 10¾	0.220	0.150

* In calculating, use the maximum machined O.D. and the minimum machined I.D. if machining tolerances are given. If only one machined dimension is given for each diameter, assume them to be the maximum machined O.D. and the minimum machined I.D.
** Allowance for wall variation is additional.

Standard tolerances for mechanical tubing apply as shown in Table 6 of "Steel Products Manual," Section 18 covering Steel Tubular Products. The O.D. machining allowances include the *under* tolerance given for the O.D. in Table 6. It is frequently necessary to adjust the O.D. to accommodate roll sizes.

Camber allowances must also be added whenever applicable.


Allowance for camber based on this distance both O.D. and I.D.
8"
8"
Tube O.D. 5.165"
Mach. O.D. 5.000"
Mach. I.D. 4.000"
Tube wall 0.737" ±12½%
Chamfer true to O.D.
Mach. wall 0.500"
I.D. mach. allowance + I.D. camber allowance + eccentricity allowance (wall tolerance)
O.D. tolerance + O.D. mach. allowance + O.D. camber allowance

EXAMPLE OF CALCULATION

Hot finish tube—machined true to O.D.

Problem: To calculate a tube size to machine to a straight cylinder 5 in. O.D. x 4 in. I.D. x 16 in. long.

Machined O.D.	5.000
O.D. machining allowance, *add*	0.145
Camber allowance, *add*	0.020
Tube O.D.	5.165
Machined I.D.	4.000
I.D. machining allowance, *subtract*	0.105
Camber allowance, *subtract*	0.020
	3.875

O.D. 5.165 — 3.875 = 1.290 = twice minimum wall thickness
Minimum wall thickness to assure required removal of stock = 1.290 ÷ 2 = 0.645

Wall thickness may vary ± 12½% (Table 6, "Steel Products Manual," Section 18). Therefore, normal tube wall is 0.645 ÷ 0.875 = 0.737

Tube size to be specified: Hot finish O.D. 5.165* ± 0.031
Wall: 0.737 ± 12½%

* O.D. would have to be adjusted to available roll size, probably 5-3/16 (5.188) or 5¼ (5.250) in which case the wall would have to be increased accordingly to protect the I.D. clean-up.

Hot Finish Tubing Machined True to I.D.

MACHINING ALLOWANCES

For machined parts Size, O.D., inches*	Machining allowances on diameter, inch O.D.**	I.D.
To but not incl. 2½	0.110	0.185
2½ to but not incl. 3½	0.125	0.185
3½ to but not incl. 4½	0.135	0.185
4½ to but not incl. 5½	0.145	0.185
5½ to but not incl. 6½	0.175	0.185
6½ to but not incl. 8	0.195	0.195
8 to but not incl. 10¾	0.220	0.210

* In calculating, use the maximum machined O.D. and the minimum machined I.D. if machining tolerances are given. If only one machined dimension is given for each diameter assume them to be the maximum machined O.D. and the minimum machined I.D.
** Allowance for wall variation is additional.

Standard tolerances for mechanical tubing as given in Table 6 of "Steel Products Manual," Section 18 covering Steel Tubular Products apply to O.D. and wall. An I.D. tolerance of plus and minus 1/16 in. is standard.

Ordinarily no I.D. tolerance is given for hot finish tubing because it is not possible to control that dimension closely in the sizing mill. The I.D. machining allowances given include the "plus" portion of that tolerance.

Camber allowances must also be added whenever applicable.

EXAMPLE OF CALCULATION

Hot finish tube—machined true to I.D.

Problem: To calculate a tube size to machine to a straight cylinder 5 in. O.D. x 4 in. I.D. x 16 in. long.

Machined I.D.	4.000
I.D. machining allowance, *subtract*	0.185
Camber allowance, *subtract*	0.020
Tube I.D.	3.795
Machined O.D.	5.000
O.D. machining allowance, *add*	0.145
Camber allowance, *add*	0.020
	5.165

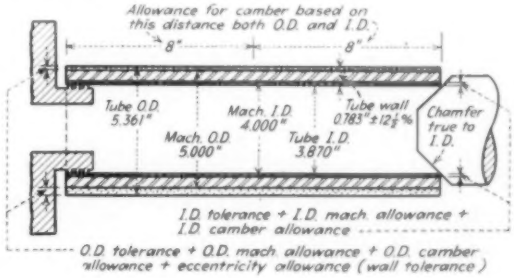
5.165 — I.D. 3.795 = 1.370 = twice minimum wall thickness
Minimum wall thickness to assure required removal of stock: 1.370 ÷ 2 = 0.685

Wall thickness may vary ± 12½% (Table 6, "Steel Products Manual," Section 18). Therefore, normal tube wall is 0.685 ÷ 0.875 = 0.783

To obtain tube O.D.:	0.783 × 2 = 1.566
plus tube I.D.	3.795
	5.361

Tube size to be specified: Hot finish O.D. 5.361* ± 0.031
I.D. 3.795 ± 1/16

* O.D. would have to be adjusted to available roll size, probably 5⅜ (5.375). I.D. would remain as given.


Allowance for camber based on this distance both O.D. and I.D.
8"
8"
Tube O.D. 5.361"
Mach. I.D. 4.000"
Tube wall 0.783" ±12½%
Chamfer true to I.D.
Mach. O.D. 5.000"
Tube I.D. 3.870"
I.D. tolerance + I.D. mach. allowance + I.D. camber allowance
O.D. tolerance + O.D. mach. allowance + O.D. camber allowance + eccentricity allowance (wall tolerance)

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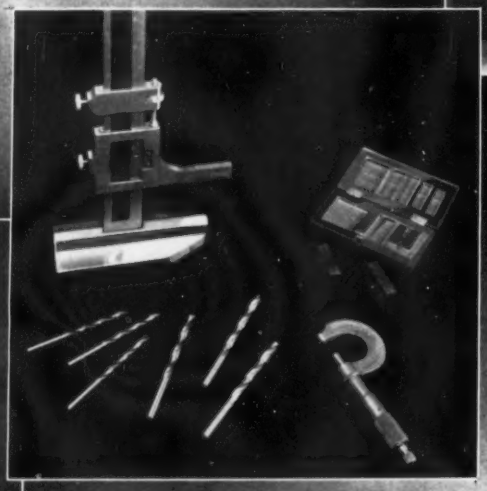

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To Overwhelm Them

TOO FEW PEOPLE seem to understand one indisputable fact: military strategy and war production go hand in hand.

To beat the Nazis and the Japs with a minimum loss of American lives we must overwhelm them with war machines. Until those machines are available at the right place at the right time in the right quantities, we shall not be able to blast our way to victory.

The longer we delay the military and naval campaigns upon which victory depends, the tougher the job will be to dislodge and defeat our enemies.

Today we are seriously behind schedule in the output of necessary war goods. Especially in aircraft, which is the spearhead of our attack on all fronts, production is lagging.

This is not put forth as scare propaganda. It is not said by high officials with their tongues in their cheeks to whip up alarm and hence stimulate greater effort, knowing privately that production really is at a satisfactory level.

It is said because the timetable for an offensive on the continent, for the bombing of Tokyo, for a campaign in Burma, is in lively danger of being set back by months because not enough war stuff is coming out of factory doors in this country.

The causes for the current failure to move the production curve upward probably are many—over-confidence, manpower troubles, the President's "demobilization" speech, changes of design, the impression that we have too much of many items.

Regardless of what the causes may be, the fact is that we are falling behind the schedule laid down for us. The thing to do is to explore every possible means of eliminating the lag.

Teamwork is needed. Management must use all of its resources to attempt to squeeze more production out of its plants. Labor must stay on the job and put into its work every day its full strength and energy. Government must see that every help is given to industry—enough equipment, enough materials, enough manpower.

Sometimes it is hard to visualize, thousands of miles away from the battlefronts, what all of this productive effort means in winning the war. Perhaps the meaning is best summed up in a recent dispatch from Ernie Pyle in Sicily, published in the *New York World-Telegram:*

"It sounds trite when it is put into words, but if you could be here and see you would understand how the might of materials can overwhelm everything before it.

"We saw it in the last days of Tunisia. We are seeing it here. We can picture it in inklings of the enemy collapse that inevitably lies ahead.

"The point is that we on the scene know for sure that you can substitute machines for lives and that if we can plague and smother the enemy with an unbearable weight of machinery in these next few months, hundreds of thousands of our young men whose life expectancy was small can some day walk again through their own front doors."

Burnham Finney

Gaging Business

War production is not rising as it should. WPB officials are keeping it on a level only with difficulty. Alarm over the situation, especially in aircraft, grows as Washington realizes how closely military strategy is tied in with output of war goods.

In July 7,373 military planes were built, but that total was below schedule. It now appears improbable that the 1943 goal will be attained. Manpower troubles and design changes have hurt. Tightening up on inspection also has reduced output. Inspectors now are so cautious that they hesitate to approve anything, following the Truman Committee's blasting of Wright.

Shifting of requirements is causing many dislocations and also is causing many people to question the need for the current production push. Tanks and ammunition are available in abundance. A group of ordnance plants has been shut down for the duration, their facilities no longer in demand.

Aircraft now constitutes 40 to 50 percent of total war production. Greatest strain is in that industry. Shipbuilding, up to schedule or above, is about half the size of aircraft.

Many manufacturers raise their eyebrows over Washington's report of a production lag. They point to hundreds of planes in the "boneyard," all ready except for certain gadgets. They know battle losses are less than expected. They are worried over astronomical inventories of materials and components.

Goals have been put so high they cannot be reached, claim critics. Aircraft will be doing well if it hits 80 percent of its 1943 quota set by WPB.

Steel and copper continue the tightest spots in raw materials. Steel is at 99 percent and should stay there the remainder of the year. Aluminum and magnesium are in good shape.

Reconversion to normal peacetime goods goes on quietly and without ballyhoo. They are mostly products essential to the war effort. Two railroad equipment builders, formerly making heavy ordnance, are back making locomotives, working 21 eight-hour shifts a week.

Six locomotive companies and two railroad shops will build 5,000 locomotives to be delivered before next July. Railroad car makers are very busy too, having just added over 6,000 cars to their backlogs and more being in prospect.

More farm machinery production is certain. Manufacturers are now retooling their plants for that purpose. Present quota of 80 percent of 1941 shipments may be increased to 100 percent or more.

Machine tool demand is falling rapidly and backlogs are being whittled as production continues around $100,000,000 a month. Some companies have little or no business now booked for the first quarter. Russian shipments the current government fiscal year will be about $125,000,000. Britain is expected to take $100,000,000 of machine tools.

WPB Shifts Few Items from "B" List; Cuts Apprehension

With industry groggy from revisions of plans and orders, WPB clears the atmosphere by refusing claimant agencies' requests for virtual elimination of "B" materials list

WASHINGTON—The list of "B" materials—standard items manufactured for stock and essential civilian items—has been virtually frozen by the War Production Board. It has been decided to transfer only a small group of items—probably less than a dozen from the current B products list, thus giving them the status of A products.

This action, although not yet officially confirmed, should go a long way toward removing the apprehension shown in industrial circles in recent months over the future of CMP.

The change is due to a controversy which arose when reports emanated from Washington that the armed services favored the virtual elimination of the B list, in order to obtain direct control over the allocation of all materials needed to execute their contracts. This would have removed them from the jurisdiction of the WPB industry division and given the claimant agencies the authority for allotments for a great many components both in the military and essential civilian programs.

Under the present system the Industry Divisions of WPB are directly responsible for the allotment of controlled materials for all B list products and it is their job to synchronize the scheduling of production of such products and the distribution of materials needed for vertical distribution for them.

Industry's objection to the alleged attempt virtually to eliminate the B products list was that the application of the system of vertical materials distribution for most items on the list would seriously disrupt the scheduling of production for such items.

Conference Report Outlines Plans for Demobilization

WASHINGTON—The Conference of Postwar Readjustment of Civilian and Military Personnel, offshoot of the now-defunct National Resources Planning Board, has issued a report containing a total of 96 more or less specific recommendations, which boil down to four basic principles:

1. Treat the problem of demobilizing the armed forces and reemploying war workers as a subheading under the larger problem of establishing a high consumption peacetime economy. Gear the rate of demobilization to the progress of industrial reconversion so that soldiers won't be discharged until there are enough jobs to go around. Plan the termination of war contracts so that some work on Army and Navy orders will continue until civilian production is ready to take up the slack.

2. Continue controls over prices, wages, etc., until the peacetime economy is running under its own power.

3. Provide educational and vocational training opportunities for both soldiers and war workers. Set up elaborate advisory services to furnish information on employment and readjustment.

4. Put the administration of demobilization and rehabilitation in the hands of a single powerful agency.

Even if things go according to plan, the conference expects postwar transition to be a bad time. It estimates that, at one time, as many as 8,000,000 men may be out of work. Even after two years of adjustment, 3,000,000 unemployed isn't an improbable figure. Unemployment may be even higher if some 6,000,000 emergency workers do not withdraw from the labor force.

REPORT SHIP DELIVERIES

WASHINGTON — The Maritime Commission reports that American shipyards during the first seven months of 1943 delivered into service 1,046 new merchant vessels, representing a tonnage equivalent to that of this country's total ocean-going merchant marine at the time of Pearl Harbor. Production of 158 new vessels in July brought the year's total delivery to 10,485,500 deadweight tons.

Facilities Near Completion

WASHINGTON—The nation's gigantic government-financed war facilities program was more than four-fifths completed at the year's midpoint, WPB Chairman Donald M. Nelson reports.

At the end of June, the completion of $12,038,000,000 of a current $14,582,000,000 government-financed war facilities program had been accomplished, Mr. Nelson said. That compares with 61 percent at the beginning of the year and only 34 percent a year ago.

Greatest accomplishments were in construction of finished munitions. Facilities for ammunition and explosives were 95 percent completed.

Conversion of Anticipated Idle Machine Tool Capacity Studied

WASHINGTON—In view of the anticipated decline in machine tool demand, plans have been discussed by the Machine Tool Advisory Committee, Tools Division, WPB, for conversion of unused capacity in machine tool plants to other war work. It is not expected that production of direct war items by the industry will approach the difference between the industry's maximum rate of operation and the potential output of machine tools in 1944, because the maximum rate was made possible by substantial subcontracting and the use of equipment and skills best suited to the task in hand. A report is to be made concerning the level of operation that can be realized by the industry in the production of machine tools and of war goods during the coming months.

Little Hope for Foreign Sales

Prospects are not good that foreign demand will bolster the order books of machine tool builders. All machine tools to be shipped to Russia in the next eleven months are now on order. No increase is anticipated in shipments to the British Empire, and it is possible that there will be a sharp reduction by early 1944.

Machine tools will be required for certain new armament programs. Retooling of existing lines to save manpower may be permitted. These two sources of new business are not presumed to alter appreciably the general outlook.

Stopping Pool Cut Output

As of June the net order position of the machine tool industry ran slightly more than one-third of shipments for the month. Monthly shipments are expected to decline rapidly as the year draws to a close. Recent discontinuance of pool orders by the armed services and WPB is a factor in forcing down machine tool production, because builders are being required to operate within their firm order pattern.

The Committee reviewed the operation of WPB Directive 23, which requires the screening of preference rating certificates for machine tools in regional and district WPB offices. This regulation is designed to get existing machine tools into use and to hold down expenditure of additional machine and man-hours for new equipment.

So Big—Thos. J. Bannan, exec. vice president, Western Gear Works, exhibits and describes the gearing of a planetary capstan to, l. to r., Capt. L. J. Stecher, Brig. Gen. E. P. Denson, Mrs. Anna Roosevelt Boettiger, Col. H. H. Galliett, and Maj. D. C. Imboden. Occasion was an inspection trip following the award to the plant auxiliary military police of the first Army guidon in the nine western states

Auto Manufacturers Worry Little Over Plane Makers Postwar Plans

DETROIT—The publicizing of William B. Stout's "Aerocar" by Consolidated Vultee, in which qualities of both aircraft and motor car are combined, does not disturb automobile industry leaders much more than do the Sunday supplement stories of the ultra-streamlined cars of the future.

While a combination of plane and automobile may catch the fancy of the people some day—and anything is possible—the development is expected to be slow, and actual manufacture will be negligible in the next five years, according to prevailing opinion in Detroit.

Detroit did not take to Bill Stout's Scarab car, but various automotive companies adapted to their own purposes some of the Scarab's features. The Scarab was a development of the middle 1930's.

Automotive leaders also are not very much excited about the threatened invasion of their field by airplane makers after the war. Never lacking in confidence, they like to boast that they can make airplanes better than aircraft people can ever make automobiles. They believe that their "know-how" of automobile manufacturing is something that it will take aircraft people years to acquire. And, above everything else they think that the problem of distribution and merchandising will lick the airplane companies in the automotive field.

It is a known fact that more ambitious independent automobile makers have stubbed their toes on distribution than on any other problem. They may have had advanced designs that the public would take to and a good car mechanically, but if they did not have adequate retail sales and service outlets, they were licked almost before they started.

Detroit is keeping its eye more on Henry Kaiser than on aircraft companies. Mr. Kaiser irritates them by his bland declarations and criticisms regarding automobile manufacturing after the war. His plans for a $400 car to be sold at filling stations convinces them that he knows little about the likes and dislikes of the motoring public. The automobile industry knows from long experience that no passenger car acceptable to the average American motorist can be built and sold for that figure. Such a car is too small and too stripped of comforts to suit John Q. Public.

PACKARD BUYS TOLEDO PLANT

DETROIT—Packard has gone in for expansion in a new direction. Not finding any further spots to place additional machinery, and being unable to get enough reliable subcontractors to take on more work to relieve the pressure at the Detroit plant, it has purchased the Aviation Corporation's new factory in Toledo. It will transfer there manufacture of many of the important parts for the Rolls-Royce engine which it is making now in Detroit.

The Toledo plant, with some very fine machinery, has been standing idle since Navy cancelled the Aviation Corporation's contracts for Lycoming engines.

Plan Standard Cancellation Clause to Ease Transition

WASHINGTON—Since late springtime, a joint committee representing Army, Navy, Maritime Commission and Treasury has been working on a standard cancellation clause, under supervision of WPB's procurement policy board. To date it has been submitted to business men for their comments, reworked and submitted again for further comments.

The establishment of a uniform clause is considered necessary for the happiness of contractors, who fear to take on new jobs, lest the war end suddenly and leave them with a large inventory from which they could realize but salvage value.

In its present form, the clause has two main objects: to reimburse contractors for actual expenses under uncompleted contracts and allow them a reasonable profit on their work, and to get money out fast so that business will have working capital for reconversion to peacetime production.

Three Ways of Settlement

To determine the settlement, the new clause provides three alternatives. If possible, procurement officials want the manufacturer and the contracting officer to negotiate a fair settlement. If they cannot reach a settlement, the new clause would give the contractor his choice of two formulas. The first would reimburse him for all costs under the contract and give him a percentage of profit on costs as previously agreed upon in the event of termination. The second provides for payment for all completed goods at contract price, payment of costs incurred on incomplete goods, plus a flat 4 percent profit on these costs.

The new clause tries to meet the problem of prompt payment by permitting contracting officers to pay out 75 percent of the "basic amount," i.e., total costs without allowance for profit, as soon as claim is filed.

Provide for Subcontractors

To take care of the subcontractors, the prime contractors would be empowered to settle with them up to $10,000. Larger settlements would require approval of the contracting officer.

With a liberal policy established on the 75 percent advance settlements, contractors would be left to cope with the removal of surplus government machinery and equipment from their plants and the purchasing of raw materials and tools for their own use. These are large problems, due, respectively, to shortage of warehouse space, and to the fact that most stockpiles now belong to the government and their release is enmeshed with the whole problem of surplus disposal and postwar inventory adjustment.

Inside Detroit

The auto industry, with justification, refuses to take unto itself the "complacency" criticism being hurled at industry by government officials. Cold, hard facts show that the automobile builders have been steadily increasing their output of war products

BY SILER FREEMAN

Shoe Won't Fit Auto Industry WPB and the Army may point their figures at others for lagging war production but not at the automotive industry. While keeping its silence officially, the industry is not a little peeved at the barrage of accusations coming out of Washington on the production job being done.

Official silence is due to the fact that no single industry has been picked as the target of the jibes. They put it down here as a "bit of morale building," or a war on complacency which has prompted Donald Nelson, General Somervell and others to hit out at manufacturers.

Industry Output Rising Steadily The auto industry rests on its records, which have shown a steady increase in monthly output since the conversion period. The annual rate has been going up, if slowly, the past few months. In April it was $8,064,000,000; in May $8,467,200,000; in June $8,700,000,000; and in July, while official figures are not yet available, the estimate of the Automotive Council for War Production statistician is about $9,000,000,000.

"In spite of some contract cancellations, cut backs in schedule and other deterrent factors, the war production chart of the industry has continued its steady rise," George Romney, managing director of the Automotive Council pointed out.

Blame Cutbacks And Statistics Spokesmen for some of the larger companies blame cancelled and revised orders for slowdowns in production here. Another thing they point out is that Washington talks about dollar volume in production, rather than units, and the dollar volume has been reduced by voluntary renegotiations.

At one time blame could be placed on materials but this factor has gradually been improving and now plays little part in the volume of production. The industry, which accepted the Controlled Materials Plan with some reluctance and misgivings, now admits that it has helped the flow of materials.

"There is still too much red tape," said one company spokesman, "but it is working out fairly well. The automotive industry has suggested several improvements in the plan which have been accepted and put into effect. There are some others which we would like to see adopted in Washington and perhaps they will be. The paper work is still heavy and something is going to be done about that. But in the main, we have a much better materials situation now than we ever had during the war."

Decline Due to New Balance George Romney sees the slowing up of the production curve as merely an indication that the war program has been put in more balance. Available materials have been balanced against contracts.

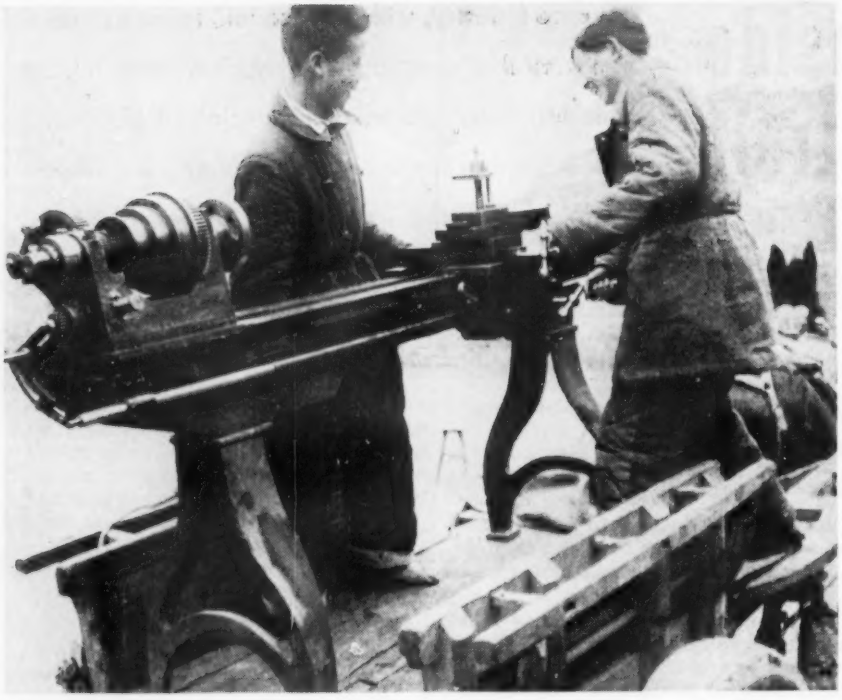
The materials situation has improved, he said, and the industry can look to more aluminum, more copper and more steel in the next six months. Indications are that whereas critical metals were the bottleneck heretofore, labor and facilities may in the future be the factors in projecting production.

Still a Good Job Was Done But what the industry boasts about is that despite occasional material shortages, cancellations of contracts, revision of orders and specifications, the manufacturers have been able to do the job and do it well, as shown by upward sweep of the production curve.

"We once had a model change a year," Romney pointed out. "Now we have model changes so fast that we don't even think of them as such. We are turning out new products, improving our old products and without a cessation of any activities except what the government directs. The industry has done a marvelous job and is still doing it."

Has Maintained Output Rate The "reconversion" of the industry has been going on for many months. The strategic changes brought about by changes in warfare have been reflected in changes in the factories. New types of vehicles, new types of munitions and guns have come out at the other end while the plants have continued in operation. There were no shutdowns, no layoffs and no great to-do about the reconversion, but in some cases it was just as

Death in a Line—The only automobile manufacturer to attempt production of complicated aircraft torpedoes, Pontiac Motor Division turns them out in the same assembly line fashion it once used for its "torpedo" auto bodies. Designed to be released by low-flying planes, each torpedo contains 5,000 parts, costs as much as a dozen medium-priced automobiles



Determination Gets Results—A lathe, made by a Chinese machine shop cooperative, is loaded on a cart by students of a Bailie school. Nine such schools are maintained by the Chinese Industrial Cooperatives to teach young refugee Chinese boys to become mechanics, technicians and accountants. Shops are established near the fighting lines, to overcome transportation difficulties, and are quickly transported to the rear when necessary. Lack of modern machinery has, in many instances, made necessary the use of primitive equipment

extensive as the original conversion from automobiles to war goods.

Plane Makers Near New Rate

The aircraft section of the industry has been forging steadily ahead to meet the new schedules given to them this year. Packard, for instance, in its just-released half-yearly report, shows that its output of Rolls-Royce engines and marine motors is 124 percent above the first six months of 1942. Willow Run, the only plant producing completed planes, is reported "on schedule" and getting into full stride to the wonderment of all. This, in spite of important changes in the design of the Liberators.

Output Reported In Simple Terms

The Automotive Council, to illustrate the rising tide of production has translated monthly deliveries and annual rate into some specific products, to give a clearer understanding of what the output means.

Aircraft, aircraft engines and parts are at an annual rate of $3,228,000,000 or the equivalent of 64,750 fighter planes. A year ago production was at the rate of 25,690 planes.

Tanks, tank destroyers and parts are at the rate of $1,320,000,000 or the equivalent of 17,600 medium tanks against an output of 5,750 tanks a year ago.

Military vehicles and parts at an annual rate of $2,140,000,000 represent 2,390,000 jeeps against a volume of 1,930,000 in 1942.

Guns are being produced at an annual rate of $766,000,000 or the equivalent of 512,000 of the .50 caliber machine guns. A year ago the output was equal to 267,000 such guns.

Marine equipment rate is $644,000,000 or the cost of 2,376 PT boats against 1,280 torpedo boats a year ago.

Ammunition output now is $150,000,000 annual rate or 45,000,000 anti-tank shells. A year ago the production of ammunition by automotive companies was 21,700,000 shells.

That is the industry's answer to Messrs. Nelson, Somerville, et al!

Large Postwar Soviet Market For Machine Tools Foreseen

WASHINGTON—Machine tools we are sending Russia will be the forerunner of a large peacetime trade with the Soviet, is the opinion of informed sources. One high government official, recently returned from the U.S.S.R., noted that at least half of the machine tools in four large Moscow factories are from the United States, and opined that this country can have the bulk of the Soviet postwar trade.

Russians respect the United States and if we treat them with the same respect, this country will have the inside track to their enormous postwar trade, he said. And it will be enormous, he continued, for Russia is "going places."

Machine tool production goes on now in Russia, though of not quite as high a quality as that of United States manufacturers. Postwar Russia will need so many tools to carry on her enormous industrialization plans that she will still purchase from the United States, and probably will not export any of her own production.

Lend-lease tools we are sending Russia are well-sown seed for future sales, he concluded. They will help, rather than lessen future sales.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

ABRASIVE PRODUCTS — No producer or importer may manufacture or sell any bonded abrasive product containing abrasive grain made from fused aluminum oxide (other than reclaimed grain) of any grit size 80 or coarser for use as one of products listed in the order. (Conservation Order M-319-a.)

CADMIUM—Restrictions have been placed on the use of this material in production of articles, limiting its use to only such articles as covered in the order. (Conservation Order M-65-a, Amended.)

CASTINGS—Maximum charges for machining which may be made in connection with the sale of high alloy castings by producers have been established on a March 31, 1942 basis. (Maximum Price Regulation 214, Amendment 1.)

CHROMIUM & STEEL ALLOYS—Restrictions have been placed on certain uses for heat resistant purposes. (Supplementary Order M-21-g, Amended.)

HAND TOOLS—Employees are permitted to use the employer's CMP preference rating in obtaining such tools for their own use on the job. Employers are also permitted to purchase them for resale to employees. (CMP Regulation 5, Direction 9.)

HEATING EQUIPMENT — Limitation on sizes and types of such surface equipment has been established for fabrication, manufacture or assembly. (Limitation Order L-107, Schedule I.)

SAFETY EQUIPMENT—No person may incorporate in the manufacture of this item, or in any component part thereof, or sell, deliver, rent, purchase, accept delivery of, or obtain the equipment in which contains such materials as listed in the regulation. (Limitation Order L-114, Amended.)

WELDING EQUIPMENT—No manufacturer or dealer can accept order for or deliver any resistance welding equipment unless specifically authorized by WPB on Form WPB-2752. This does not apply to orders received prior to July 27 this year. (Limitation Order L-298, Amended.)

Wartime Washington

The reconversion to peacetime-type products is beginning. Some renegotiation relief may be in the offing for certain industries. Standard questionnaires ease burden. Expect Truman Committee to recommend amendment to the renegotiation law

The Taper-Off Has Begun A lot of producers are being turned back to the manufacture of peacetime-type products, in keeping with WPB's announced intention of keeping output at a peak and of maintaining civilian economy at a high level. No plan is being followed in making this shift: just force of circumstances. Locomotives, farm machinery and heavy trucks — possibly cars by next year—are in the vanguard of the conversions.

Some Will Take Re-Tooling Farm machinery may be expected to offer the largest opportunities for sales of machine tools. Many of the farm machinery factories had their machine tools removed to plants producing war goods; now they're ready to purchase replacements. Locomotive manufacturers, on the other hand, have been producing tanks and much the same machinery was kept in place and used; so, little will be needed for the return to peacetime production. The same is true of heavy truck manufacturing: the producers have been turning out war products of closely similar character.

CONSULTANT DIVISION SET UP

WASHINGTON—WPB has established a Management Consultant Division, to advise on broad management practices to promote effectiveness in war production. John W. Nickerson, Manchester, Conn., has been appointed director.

The new Division will give special emphasis to studies and recommendations as to wage incentive plans, production standards, etc. The Division is authorized, upon request, to advise the War Labor Board as to the probable effects on costs, wages and production of proposed incentive plans submitted by labor and management.

Renegotiation Relief Hinted The renegotiation purge goes on, with procurement agencies announcing a total of $3,555,174,000 saved, to June 30. When Congress reconvenes in mid-September, the Disney Subcommittee of the House Ways and Means Committee will go into session, and will review testimony piled up by the House Naval Affairs Investigating Committee. It's in the wind that laws will result which will give certain industries, such as machine tool building, special consideration in renegotiation; that this will probably take the form of some sort of technical loophole giving the contractor's lawyer a chance to reach through and hold some of the profits in his client's till. Finding it impossible, in some instances, equitably to establish long-range price adjustments, the War Department Price Adjustment Board has arranged with certain producers for a quarterly review of their profit situation. The review will be in the nature of a voluntary report, and will not be an audit. The majority of price adjustments are, according to law, for one year.

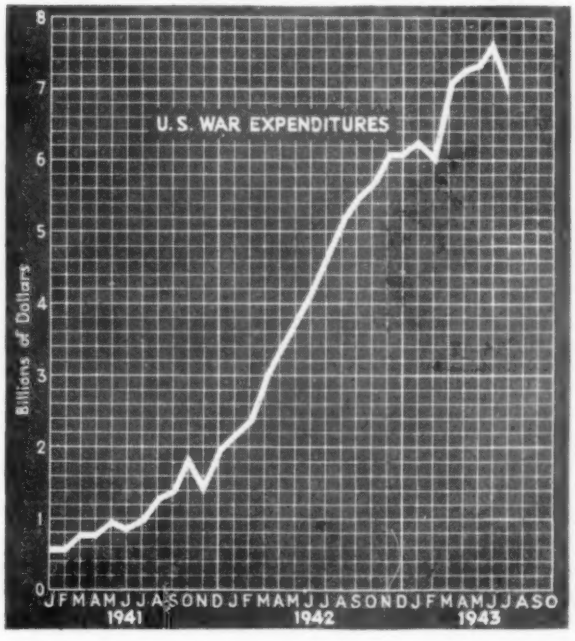
Termination Clause Near The standard termination clause is about to become a reality in procurement contracts. Designed to avoid war-end confusion and to establish an equitable procedure for disposing of partially processed war goods and untouched inventory, the clause has been the subject of innumerable conferences between legal departments of the procurement agencies. Already a greater dollar total of war contracts has been cancelled than at the end of the first World War; however in this instance cancellation has been usually followed by conversion. But with war-end the producer will have his munitions contracts cancelled, while no further government orders are laying around awaiting him.

Established Own Board To care for renegotiation of contracts of the Reconstruction Finance Corp., another price adjustment board has been created under the chairmanship of Charles T. Fisher, an RFC Director and president-on-leave of the National Bank of Detroit. This newest of the price adjustment boards will determine its policies at an early meeting. Whether it will adhere to the joint policies established by the War, Navy, Treasury and Maritime Commission boards has not been indicated.

Questionnaire Standardized In an effort to simplify renegotiation and to make it as painless as possible, a uniform questionnaire has been adopted by the five government price adjustment boards. It is hoped thereby to bypass the multitude of contractors who need not be renegotiated.

Consider Amendment It is understood the Senate (Truman) War Investigating Committee has drawn up an amendment to the renegotiation law and is circulating copies for study by government officials. The amendment is said to follow the committee's original report on renegotiation.

Blamed on Production—The 4.7 percent drop in war expenditures in July has been attributed partly to Treasury bookkeeping adjustments, partly to decline in production. July expenditures were $7,112,458,704, while June totaled $7,469,266,674



"Workers Are Soldiers," Navy Incentive Division Emphasizes

WASHINGTON — That management has a 24-hour-a-day responsibility to keep the worker convinced that he is a soldier on the production front is the guiding theory behind the Navy Department's Incentive Division. To help management carry on this program is the work of this division.

The program, set up during the fifteen months since establishment of the division, includes posters, motion pictures, "battle communiques," pictorial spreads, plant visits and exhibits. Efforts are made to effect the trial of new production methods and the adoption of those found reliable.

Through it all, the program emphasizes the belief that each plant has its own individual problems, and that the Division offers its services only as a helper and adviser. Contact is made with and carried on through the labor-management committees, and in conjunction with the War Production Information Committee.

The motion picture program has proven popular and effective. Already over 1,000 plants have subscribed to the service, though it has been in effect but a short time. Each film is the story of a single war weapon—ship or plane—or it may emphasize the importance of careful workmanship for the safety of our soldiers, or detail the place of women workers in war industry.

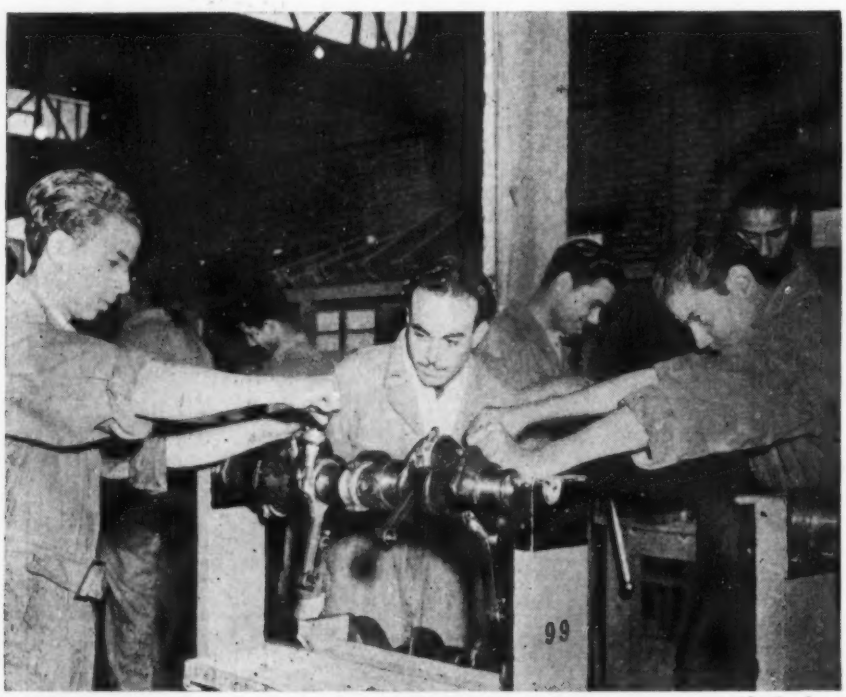
Returned fighting men, as Cpl. Barney Ross, who suffered four shrapnel wounds while killing 22 Japanese and saving the lives of 6 comrades, and Seaman Basil Dominc Izzi, who spent 83 winter days adrift on a raft, have been taken to speak before plant groups. In their talks they have emphasized the importance of plenty of well-made equipment, for "we can't fight a damn lick if you don't furnish us the equipment."

Battle communiques, reporting to workers the performance of the equipment they made, have proven popular and effective.

The Incentive Division has district offices spread throughout the country, the better to work with plants in staging rallies and preparing material fitted to their individual needs.

The radio section encourages broadcasters to use incentive material, and has received excellent cooperation in this respect. Many radio advertisers have been particularly helpful and some, such as Coca Cola, have staged broadcasts in plants, both to honor the employees and to impress them with the importance of their work.

Rear Admiral Clark H. Woodward, U.S.N., is chief of the Industrial Incentive Division.



U. S. Army

In the Shadow of the Sphinx—Faced with the need of large on-the-spot corps of motor rebuilding mechanics, the U. S. Army Services Forces in the Middle East decided to train young men of the native population, devised training methods suited to the background of the students, set up recreational programs and guaranteed graduates jobs in the base workshops of the area. Native Egyptian boys, above, have proven able to learn quickly, have extraordinary finger dexterity. To this training program has been attributed much of the success of the battle of supply, an important factor in driving the Axis from Africa.

Groups Join to Fight Waste of Cutting Tools

WASHINGTON — Reduction of the enormous wastage of industrial cutting tools is the purpose of a joint campaign of the National Industrial Advertisers Assn., the Division of Information of the War Production Board and the War Advertising Council.

Nine million new, inexperienced workers have been a great cause of increased cutting tool breakage, according to a campaign booklet issued by the War Advertising Council and the War Production Board. Principal sources of this waste, which presents a serious meance to our war production effort are: (1) breakage and spoilage of tools caused by carelessness or lack of knowledge of tool handling and use; (2) dulling and other damage resulting from lack of care when the tool is not in use; (3) needless scrapping when tool can be repaired or new tools created by "tipping," grinding, brazing and other methods.

Conservation is a "Must"

"The waste of tools is mounting at an alarming rate while inventories are falling proportionately, production costs are raised and production schedules impaired." Sufficient extra materials are not available for increasing tool production and most of these materials must be obtained from distant sources. Similarly, new and costly facilities would be needed to produce these facilities.

The campaign will have as its slogan, "Tools Are Weapons—Treat 'em Right!" It will appear in industrial advertising and on posters available to metal working plants.

It is planned to fight unnecessary waste: (1) by education of plant workers, both new and old, to the importance of tool conservation and in methods of making tools last longer; (2) by acquainting management personnel, from plant manager to tool foreman, with the seriousness of the situation and impressing on this group the necessity for education of workers and the importance of continuous conservation effort; (3) by focusing attention on the problem throughout the metal working industry; and (4) by encouraging more widespread adoption of tool salvage practices.

Spotting The Air News

Aircraft production is suffering from shortage of manpower. Shortly the decision must be made whether to devote manpower to making or using materiel. Newly developed wind tunnel will simulate altitude. Gliders are approved by Army

Manpower trouble is the main reason why aircraft production is staying on a three-month-old plateau. With few exceptions the supply of materials and components is satisfactory. In other words, materials have caught up with labor. Positive remedies could be applied, and may have to be. For instance if the high command decides to go further into strategic air war at the expense of other arms, there could be more conversion from ordnance, ammunition, vehicles, or ships to aircraft. The War Production Board says it still aims at 10,000 planes per month, an increase of nearly 3,000 over the present rate, by the first of the year.

It might be possible to squeeze that many more planes (the tonnage would be proportionately greater) out of the industry through measures now being taken. National Selective Service has ordered a limited blanket draft deferment for aircraft workers on the West Coast, where the manpower shortage is most acute. This deferment is extendable to subcontractors. Selective Service didn't want to issue the order in favor of one industry because it would stand as an invitation to others. But the Army insisted and it was done.

At the same time the War Manpower Commission issued a "critical list" of numerous aircraft occupations, for the attention of all draft boards having jurisdiction over West Coast workers. While not an order, it was hoped that the list would hurry nonessential workers into aircraft shops in the hope for draft immunity.

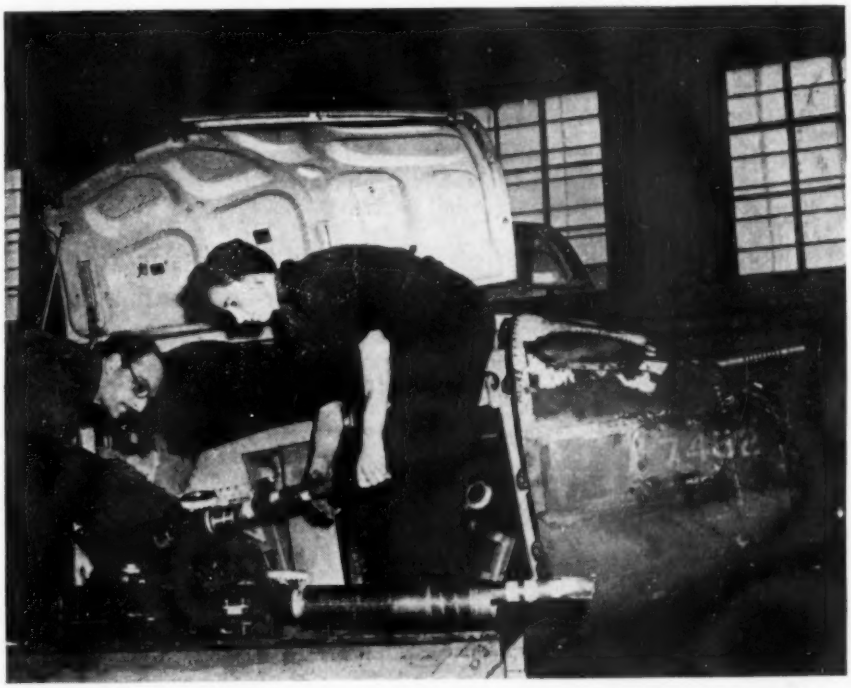
J. W. Kindleberger, president of North American Aviation, builders of the hot Mustang fighter P-51 and the medium bomber B-25, says that Coast companies have given up 68,000 men to the armed forces, are now short 20,000 and must have 36,000 by the end of this year. He estimates that 58,000 now employed are vulnerable to the draft. That figure includes 38 percent of the engineering personnel, 24 percent of tooling employees, and 23 percent of inspectors. Kindleberger explains that the industry's key personnel will make up a very small fraction of military manpower requirement, but their removal can do great damage to the aircraft program.

Any way you look at it, the manpower market is dry. The question is, how shall available workers be divided up. If the aircraft industry must have more workers, they will have to be taken away from other industry or away from the military.

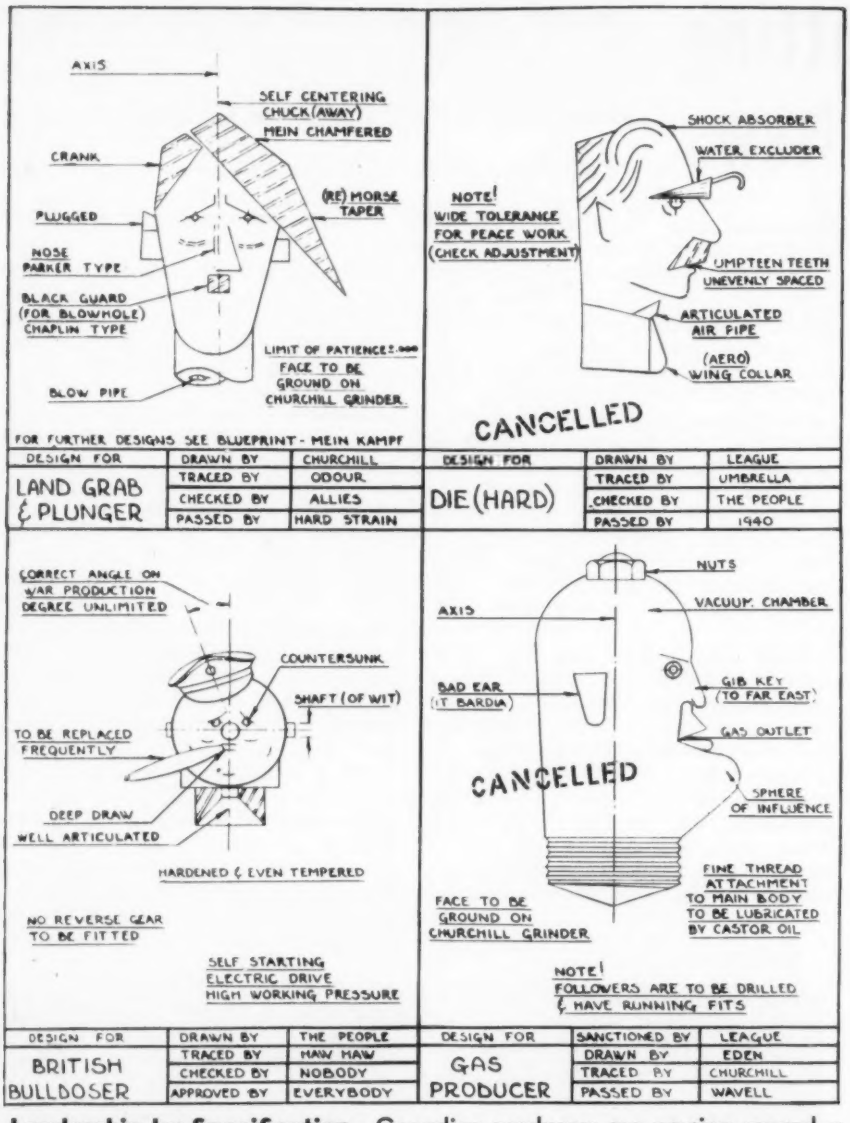
The replacement program is practically a dead letter. That is a scheme under which a manufacturer is allowed a given time in which to train workers to replace those the services have taken and deferred. Along about the first of the year a lot of these deferments are going to run out, and the airplane builders will lose thousands of men. They simply cannot find suitable persons to train as replacements.

Wind tunnels for years have been doing just one thing: blowing wind to test models or full-sized airplanes. They have contributed more than any other aerodynamic technique to the design of efficient wing sections. But now they will do more. Speed of the supporting air stream is only one thing: two other important things are density and temperature. Obviously, cooling a windstorm to 70 below, and reducing air to the density of 50,000 ft. of altitude, is a big job. But Army's great laboratory at Wright Field, Dayton, is doing it. A circulating tunnel with a ten-foot throat (for models only) will generate speeds up to 600 m.p.h. This requires two 20,000 h.p. motors running two blowers. The low temperatures are obtained by large refrigerating coils plus expansion (due to increasing the speed) of the air. Low pressure is of course a partial vacuum, with outside atmospheric pressure held off by steel plate construction varying in thickness from ⅜ in. to 1¾ in.

The Army committed itself, the other day, to unrestricted glider warfare, by putting on a showy demonstration at Maxton Field, North Carolina. Precision landings in obstructed areas, and landings at night with just as much precision plus uncanny silence, convinced a large gathering of press and military observers, including General H. H. Arnold, chief of the Air Force, who had entertained some doubts. The art of towing powerless planes will be well developed for further postwar test as a cargo carrier.



Installing the Stingers—At a Lockheed reassembly division base in the west of England, British men and women alter American-made aircraft for action in the European theater of war. Above, two workers install guns in a Lockheed Lightning P-38 fighter, preparatory to its flying to the Mediterranean battle front



Leadership by Specification—Canadian producers are passing around a blueprint giving detailed specifications for some of the war leaders, past and present

Ordnance Cites Designer For War Part Replacement

CLEVELAND—Frank B. Marbach, superintendent and tool designer for Morrison Products, Inc., has been cited by U.S. Army Ordnance because he "has rendered distinguished service to his country in the struggle to maintain the freedom of all people. By the exercise of his initiative and ingenuity he has made a marked contribution to the vital war production program to conserve critical material and machines."

Mr. Marbach designed an elevating handwheel used on the 30 caliber M-2 machine gun. The value of his contribution lies in the fact that it is not merely a new design but a conversion involving the use of less critical metal, the elimination of several operations and the speeding up of production. The design is based on assembled stampings.

Will Aid Students to Resume War-Interrupted Schooling

LONDON—A scheme for the further education and training of young men and women whose studies have been interrupted by the war has been announced by the British government. Candidates will be selected according to ability to undertake the desired course with profit to himself and the nation. Refresher courses will be available for older persons.

If insufficient need exists for national assistance to return a profession to normal, a candidate who shows promise may be told that no such aid is available, and advised to take other training. A government committee will determine the number of persons that should be encouraged to seek various kinds of further education or training, in the light of prospects of employment at home and abroad. The government has formed a committee to give advice.

A successful applicant will receive a grant enabling him to take the full course of training required. Those who apply for a long or expensive training will be required to show special promise of a successful career.

Married candidates who apply for university courses will receive special consideration, and grants for courses at overseas universities will be made. While men and women who have been discharged from war service and who are not required for other forms of national service, may apply for aid at once, the scheme will not come into general application until the war ends.

BUSINESS ITEMS

Ransome Machinery Co., Dunellen, N. J., makers of welding, road paving equipment and concrete mixers, has been acquired by Worthington Pump & Machinery Corp., Harrison, N. J., as a wholly-owned subsidiary.

Ohio Crankshaft Co., Cleveland, has appointed five machine tool dealers as special Tocco sales agents to handle its line of induction process heating and hardening equipment. The dealers include Strong, Carlisle & Hammond Co., Cleveland; Syracuse Supply Co., Syracuse, N. Y.; William K. Stamets Co., Pittsburgh; E. A. Kinsey Co., Cincinnati; R. R. Stephens Co., St. Louis.

Westinghouse Electric & Mfg. Co., E. Pittsburgh, has established a group of electronic engineers to guide and direct the industrial, central station and transportation electronic applications. This central organization will act as consultants and coordinate the efforts on new developments pertaining to the electronic methods of doing specific jobs. Gordon F. Jones and Carl J. Madsen will head the industry engineering group, while Amos J. Germain will have charge of the industrial department activities. Mr. Jones will specialize as consultant on conversion problems, and Mr. Madsen will devote his time as consultant in connection with electronic methods in process and speed control, induction and dielectric heating.

McKenna Metals Co., Latrobe, Pa., manufacturers of Kennametal products, has been succeeded by Kennametal Inc., with personnel, management and products remaining the same.

Dow Chemical Co., Midland, Mich., has opened an office in the Terminal Tower Bldg., Cleveland, and will serve that city, Pittsburgh, Buffalo, Toledo, Dayton, Cincinnati, Columbus, Akron and Detroit. Concerned chiefly with products of magnesium, it is planned to expand operations to that of a general sales office later on. D. T. Wellman will head this branch office.

Emerson Engineering Co., makers of precision products for the aircraft industry, has opened offices and manufacturing facilities at 1418 S. Flower St., Los Angeles, headed by E. V. Miller, formerly vice president of Aircraft Tools, Inc.

H. M. Harper Co., producers of bolts, nuts, screws, iron hardware, has announced the opening of a branch office in Philadelphia at 1617 Pennsylvania Blvd., with George W. Ellis and Henry F. Mullaney in charge.

Bell Aircraft Corp. Ordnance division, manufacturing many types of gun mounts and adapters for aircraft and naval use, is moving to Burlington, Vt. from Buffalo where it will occupy additional space for the expanding production of the division.

Robertson Art Tile Co. of Trenton, N. J., makers of vitrified bonded abrasive grinding wheels, has changed its name to Robertson Mfg. Co. All tile making was discontinued the first of this year for the duration.

Dowty Equipment Corp. of Long Island City, N. Y., has changed its name to Hub Industries, Inc. The management of the organization remains as heretofore and the company will continue to manufacture landing gears, gear and hand pumps, filters, selector valves and related products.

NAMES in the NEWS

C. R. Osborn

E. B. Newill

C. R. Osborn has been advanced to vice president of General Motors Corp. in charge of the Electro-Motive Div. at LaGrange, Ill. He became associated with the firm as an apprentice in the Dayton Engineering Laboratories Co. in 1921, and since 1941 Mr. Osborn has been assistant to R. K. Evans, vice president in charge of the general engine group which includes the Electro-Motive Div. E. B. Newill, assistant to E. F. Johnson, vice president in charge of the Eastern Aircraft and General Motors Divisions in Dayton, has been named general manager of the Allison Div. in Indianapolis. Mr. Newill joined the organization in 1929 as vice president of General Motors Radio Corp., and in 1930 transferred to the Frigidaire Div. He became assistant to E. R. Breech, vice president of G. M. in charge of household appliances and aviation in 1941.

C. L. Huston, Jr.

C. L. Huston, Jr., assistant to the president of Lukens Steel Co., has been named president of Lukenweld, Inc., Coatesville, Pa., fabricator of welded structures used in marine and rail transportation and for industrial machinery. Previous to his association with Lukens, Mr. Huston served 10 years with American Rolling Mill Co. in Middletown, Ohio, having spent part of that time in the metallurgical department and the remainder on the personnel relations staff.

Tracy Langdon, vice president of D. A. Stuart Oil Co., Chicago, has resigned to become an executive of American Oil & Supply Co., Newark, N. J. Mr. Langdon was connected with the Stuart company for 23 years, and had been vice president and sales manager for the past 14 years.

C. T. Ruhf was elected president of Mack Trucks, Inc., Long Island City, N. Y., at a recent meeting of the board of directors. Mr. Ruhf has been connected with Mack since 1912 and has been president of Mack Mfg. Corp. and executive vice president of Mack Trucks, Inc., the parent company.

Alfred M. Wilson has been appointed vice president of Minneapolis-Regulator Co., Minneapolis, makers of controllers, thermostats, switches. Since joining the firm in 1941 he has been serving as assistant to the president.

John B. Lawson

John B. Lawson has been elected vice president of Ferracute Machine Co., Bridgeton, N. J., press builders. He joined the company in 1941 as comptroller and reorganized the firm to meet the requirements of a rapid expansion. Before his association with Ferracute, Mr. Lawson was comptroller of Villanova College, and had previous experience in the treasury department of Warner Bros.

George R. Murray and Edgar S. Hutton have been named vice presidents of Chambersburg Engineering Co., Chambersburg Pa., makers of hammers and other forging equipment Mr. Murray is also works manager, while Mr. Hutton is treasurer of the company.

William J. Russell, formerly manager of engineering at Westinghouse Electric & Mfg. Co., Appliance Div., Mansfield, Ohio, has been named vice president in charge of engineering for Landers, Frary & Clark Co., New Britain, Conn., producers of vacuum cleaners, washing machines, ranges, electrical heating appliances.

Blank & Stoller
H. M. Horner

John Haley
Raycroft Walsh

John Haley
E. E. Wilson

E. E. Wilson has been named vice chairman of United Aircraft Corp., E. Hartford, Conn., but will continue as president. Among other executive changes announced is the appointment of Raycroft Walsh to the executive committee, who will continue as senior vice president. H. Mansfield Horner has been designated vice president in charge of manufacturing and will coordinate the activities of all the divisions of United Aircraft while continuing as general manager of Pratt & Whitney Aircraft Division.

William B. Griese has been appointed plant manager of Spencer Heater Div., Aviation Corp., Williamsport, Pa. He was formerly plant manager of the liquid cooled engine division of Aviation Corp. at Toledo.

Walter E. Watson has been made first vice president of Youngstown Sheet & Tube Co., Youngstown, Ohio, a newly created position. He will continue in charge of sales.

Thomas W. Pettus, formerly sales manager of National Bearing Metals Corp., St. Louis, has been advanced to vice president in charge of sales.

Head G & N Mfg. Div. of Camco

M. Brainard

Shelburne
G. A. Collier

Millar Brainard has been named president of the G & N Mfg. Div. recently acquired by Cleveland Automatic Machine Co., Cleveland, manufacturers of automatic screw machines and single spindle automatics. This division makes a line of high pressure, hydraulic die-casting machines and plans to step up development of the magnesium alloy casting machine and of the injection molding of plastics. George A. Collier, who has directed Camco sales for several years, is now general sales manager of the combined divisions, while Mr. Martin is sales manager of the G & N Division.

Leo. B. Thomas

Leo B. Thomas, formerly vice president and general manager of Edward Katzinger Co., Chicago, makers of kitchen utensils, flashlights, tinware, has become president of the company. In 1929 he joined Butler Bros. of Chicago as assistant merchandise manager and later became a buyer for hardware and electrical lines for all Butler houses.

Charles L. Beard has been appointed a vice president of Bell Aircraft Corp., Buffalo, in addition to his position as secretary of the corporation.

Ray F. Ellis has been advanced to assistant general sales manager of E. C. Atkins & Co., Indianapolis, saw makers, to assist K. W. Atkins, vice president and general sales manager. Mr. Ellis has served the company for 30 years in several important capacities.

Fred M. Young has become vice president of Western Metals Specialty Mfg. Co., Milwaukee, makers of auto specialties, engine and stoker housings, switch boxes. Formerly Mr. Young served as president and general manager of Young Radiator Co. of Racine, Wis.

Elliott W. Beckett, previously St. Louis sales manager of Continental Can Co., has been named vice president and general manager of Continental Can Co. of Canada, Ltd., with headquarters in Montreal.

Frank A. Rudolph has been appointed eastern regional manager of Aircraft Accessories Corp. with offices in Rockefeller Center, New York City. For some time he has been in charge of that office, and was previously connected with General Electric Co. in the radio, television and electronic division.

OBITUARIES

V. Teunissen
A. Kingsbury

Albert Kingsbury, inventor of the thrust bearing used on most American warships, and founder and president of Kingsbury Machine Wks., Philadelphia, bearing makers, died in Greenwich, Conn. at the age of 80 years. He established the firm in 1918 and had been president since the company was incorporated in 1925. From 1891 to 1899 Mr. Kingsbury was head of the engineering department of New Hampshire College, and then became associated with Worcester Polytechnic Institute as professor of applied mechanics. In 1903 he joined Westinghouse Electric & Mfg. Co., E. Pittsburgh, as mechanical engineer, then became a consulting engineer in 1910 in addition to directing his own manufacturing business.

George A. Mohr, 56, vice president and works manager, Boye & Emmes Machine Tool Co., Cincinnati, makers of lathes, tapping equipment, hydraulic drilling machinery, died suddenly of a heart attack. He joined the company in 1910 as a draftsman and became works manager in 1928.

George W. Long, 51, vice president of Simmons Machine Tool Corp., Albany, N. Y., rebuilders and manufacturers of machine tools, was drowned in Lake George, N. Y., while canoeing. Mr. Long had been connected with the firm for over 30 years and was recognized as an authority on all types of machine tools. During the last 2 years he had frequently been consulted by the Army and Navy to assist in locating critical machine tools.

L. S. Horner

L. S. Horner, 68, president of Niles-Bement-Pond Co., one of the country's largest machine tool manufacturers, passed away while on a visit to Wolfeboro, N. H. He had served as industrial advisor for the American Hardware Assn. He began his career as an electrical engineer for American Telephone & Telegraph Co. in 1898, then joined Acme Wire Co. of Hamden as sales manager and vice president. Col. Horner served in the Spanish-American War, and in the first World War he was chief of staff of the Bureau of Aircraft Production in Washington.

Standish Backus, 68, president of Burroughs Adding Machine Co., Detroit, died of a heart attack in a New York hospital where he had been a patient since January. He had been a director of many leading Detroit corporations. From 1911 to 1917 Mr. Backus was secretary of General Motors Corp., and general counsel from 1917 to 1920. He left General Motors that year to assume the presidency of Burroughs.

Rufus Gardner Kellog, one of the founders of Louis Allis Co., Milwaukee, makers of electric motors, generators, died recently at his home in Florida. He had also been sales manager of the Square D Co. of Milwaukee, producers of electric motor starters and controllers.

Harry Payne, vice president of Youngstown Welding & Engineering Co., Youngstown, Ohio, passed away in that city a short time ago.

Frederick Paul Wessolek, 56, general superintendent, Ohio Crankshaft Co., Cleveland, died recently in that city. He was employed with the company since 1920 and worked his way up from machine operator.

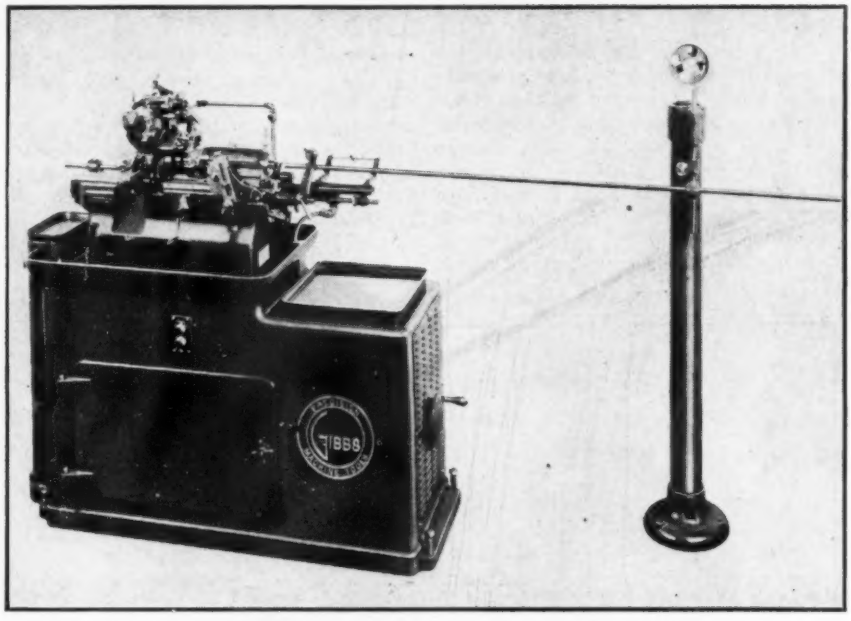
MEETINGS

Society of Automotive Engineers, Aircraft Engineering & Production meeting. Biltmore Hotel, Los Angeles, Calif. Sept. 30-Oct. 2.

National Metal Congress & Exposition Annual meeting, Palmer House, Chicago, Ill. Oct. 18-22.

American Welding Society. Annual meeting. Hotel Morrison, Chicago, Ill. Oct. 18-21.

Shop Equipment News



Gibbs Automatic Screw Machine With Five Cutting Tools Performs Turning and Knurling Operations in One Cycle

For making small precision parts at high speed, Thomas B. Gibbs & Co., Delavan, Wis., has developed a Model 375 automatic screw machine built with five cutting tools. It is capable of performing a wide range of diameter, form, taper and radii turning, including knurling operations, in one cycle. The machine has a bar capacity of ⅜ in., and will turn parts having a maximum length of 2½ in. A stepless range of spindle speeds from 1,000 to 10,000 r.p.m. are provided in this screw machine.

The cutting tools are controlled by flat cams equipped with lateral and vertical micrometer adjustments to control the positioning. Small precision parts can be turned on this machine to tolerances of ± 0.0002 in diameter and concentricity. The toolhead is designed for use with or without guide bushings.

The chuck opening and closing in the spindle is controlled by two dogs which require axial adjustment only. Lubrication of the spindle bearing is through sight drip oilers. The camshaft is mounted behind the bed and parallel to it. All of the cams which control the movement of the headstock, the opening and closing of the headstock collet, the operation of the five tool slides and attachments, are controlled from this shaft. A lever for manual operation of the camshaft facilitates adjustment of the tools and cams during the initial set-up. Camshaft speed control is accomplished by four quick-change gears. A 3 hp., 3 phase, 60 cycle ball bearing motor is mounted in the base of the machine, as well as the oilproof pushbutton station and magnetic starter.

Ample coolant circulation is provided by a centrifugal pump driven by direct couplings to the gear box drive, eliminating belts and numerous oil fittings. The reservoir is cast integral with the base and has a special chip collector to reduce oil contamination to a minimum.

Five attachments can be provided for this screw machine which include a single spindle drilling attachment for both positive and sensitive drilling, a single threading attachment for cutting outside threads of various diameters, two spindle drilling and tapping attachments to perform both operations in one cycle, a three spindle drilling attachment which can be used for spotting, drilling and reaming. It is also possible to drill holes of several diameters with this spindle attachment. Another attachment available is for screw slotting.

Additional modifications to the basic machine have been developed to permit the turning and hobbing of pinions in one production cycle. A further modification of the screw machine permits the use of an attachment which will perform both milling and cross drilling of the turned piece in the same turning cycle.

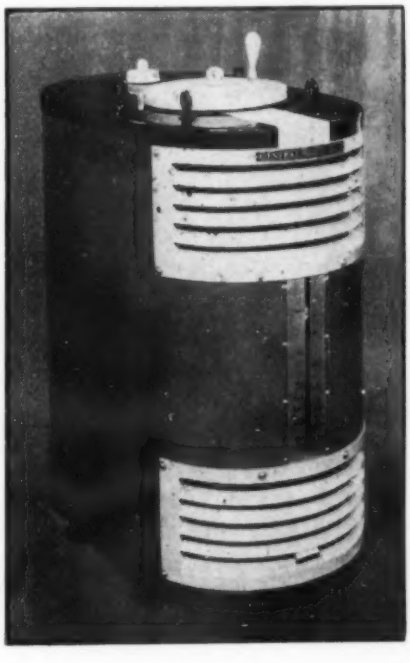
General Electric A.C. Welder Has Automatic Voltage Control

An outdoor alternating current welder has been introduced by General Electric Co., Schnectady, N. Y., which has a welding current range from 100 to 625 amp. at 40 volts.

A feature of this welder is the "idlematic" control which automatically reduces the output voltage to less than 35 volts whenever the arc is not in operation, but provides full power for welding as soon as the arc is struck. The control also includes a switch operated by a handle extending through the top of the case for use in stopping or starting the welder manually.

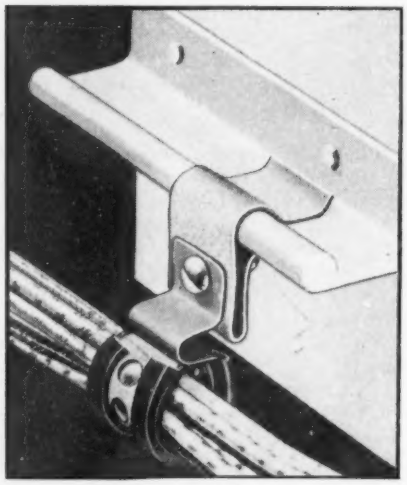
All features of the indoor a.c. welder have been incorporated in this type, including built-in power factor improvement which provides low current input for maintaining the power factor at 95 percent, or at all loads between 40 and 70 percent of rating. The unit also includes finger-tip adjustment, stepless current control, fan-forced ventilation, and capacity for operation with long leads. The welder is protected by drip-proof construction of the opening in the top of the case, and by a sealed window over the current indicator. Wide louvers serve to shed water and to keep air velocity low. The internal parts all have a special finish for protection against corrosion from moist air.

All openings in the top of the case are built to protect the unit against the entrance of snow and rain.



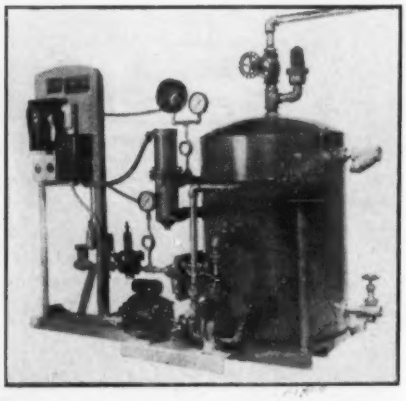
Tinnerman Wiring Harness Clamp Provides Independent Wire Hold

For use in other equipment as well as aircraft, Tinnerman Products Inc., 2102 Fulton Road, Cleveland, Ohio, has produced a wiring harness clamp with a latching finger. The clamp works independently of the attaching screw in



the assembly of the wire. The wires may be removed or replaced without loosening the screw that holds the clamps in position. Six sizes of the clamps are available to accommodate wire bundles varying from 1/16 to 1⅜ in. in diameter.

The clamp is used in place of "boggles" at the point of make-up. They can be snapped over the wires prior to transportation to final assembly location, and then will serve as the mounting means for attaching the harness to the structure. The unit is made of parkerized spring steel and finished with two coats of lacquer. For size adjustment to fit a varying number of wires, two different latching stations are provided on each clamp. The clamp is cushioned with synthetic rubber.

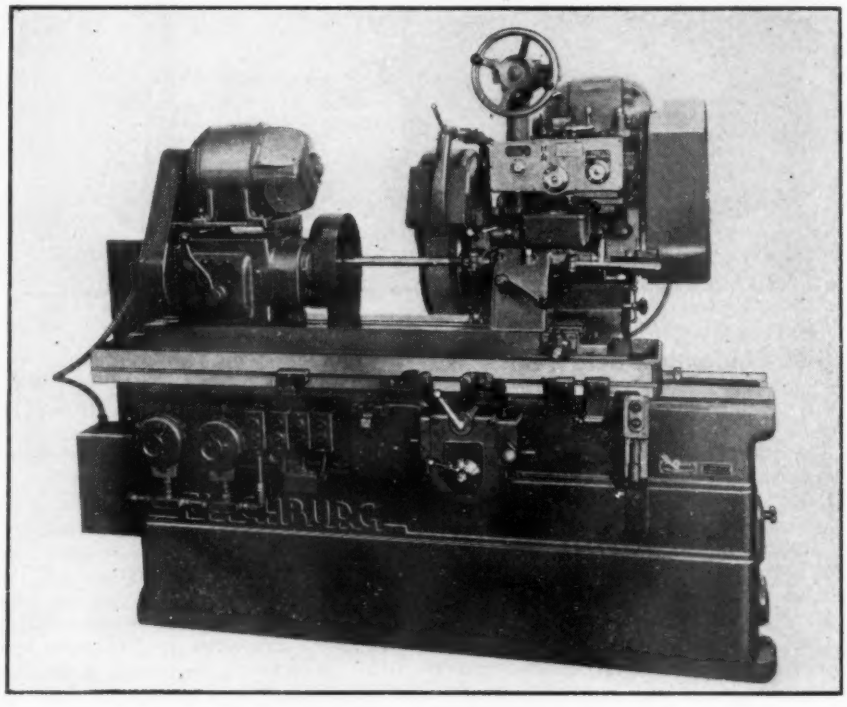


Circo Dee Tee Vapor Cleaner Will Remove Worn Lubricant

For removing worn lubricant, dirt, grit and moisture from internal surfaces and areas, such as differential, transmission or other gear case, the Model 35-S Dee Tee vapor cleaner is being offered by Circo Products Co., 2835 Chester Ave., Cleveland 14, Ohio. The vapor cleaner uses Dee-Solve solvent which, when heated creates a constant flow of hot vapors which penetrate through the worn lubricant to the metal.

The unit is operated by throwing the main switch, and a green light indicates that the equipment has been turned on. The operation is completely automatic and can be controlled to apply the required amount of vapor. The proper solvent level is automatically maintained by the liquid level control. When the solvent level drops, this control turns on the pump which operates until the original solvent level has been restored. The cleaner measures approximately 64×45×47 in. high, and weighs 925 lb.

The unit is equipped with a vapor generator tank 30 in. high and 24 in. in diameter. Capacity of the tank is 35 gal. The solvent in the tank is heated by steam coils and converted into hot vapor at low pressure, and passes through the main control valve into the vapor manifold which has five outlets, more or less as required, each having a vapor control valve and a 6 ft. long flexible tubing. In case the solvent drum is empty the control lights a red light and the steam is shut off.



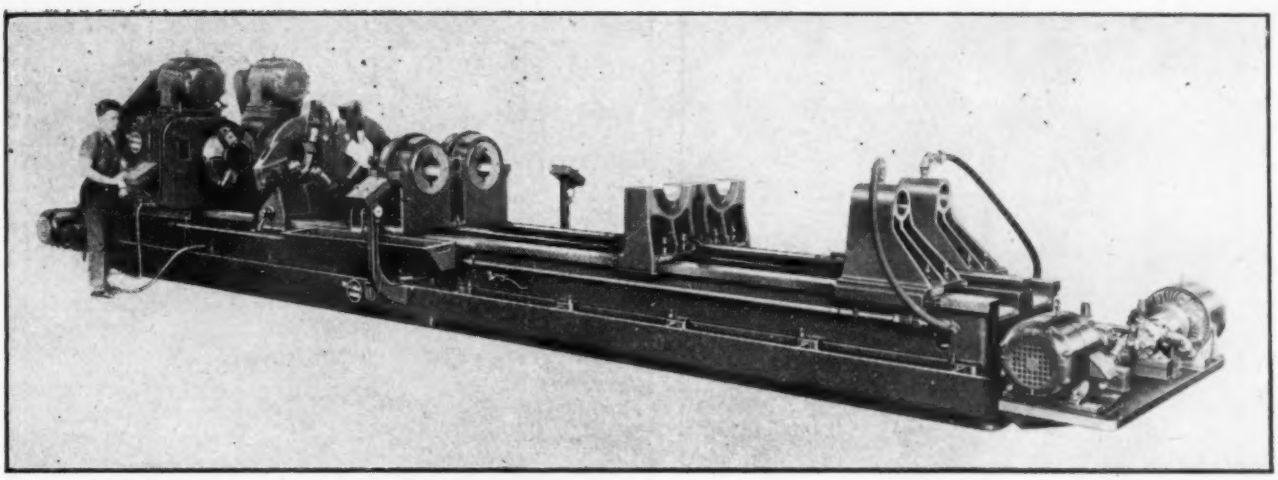
Fitchburg Type B Plain Cylindrical Automatic Grinder Made in 6 and 10 In. Sizes to Handle Various Types of Work

Development of Type B plain cylindrical automatic grinder in 6 and 10 in. sizes has been announced by Fitchburg Grinding Machine Corp., Fitchburg, Mass. The machine is equipped with a fixed standard bowgage wheelhead unit. A pushbutton provides means of starting the head through a completely automatic cycle of rapid traverse to the work, correct feed, grinding dwell and return. Feed movements may be controlled in 0.00001 in. on the wheel feed dial. The wheelhead unit has individual motor drive by means of a 5 to 20 hp. motor, depending on the size of the wheel, and infinite range of feed rates.

Normal swing over the table of the 6 in. model is 6 in., maximum 9 in., while on the 10 in. grinder the normal swing over the table is 10 in., with a maximum swing of 13½ in. The smaller machine is made in two sizes, 6×18 and 6×32, having a maximum distance between centers of 19¼ and 31½ in. respectively. The 10 in. machine is built in three sizes, 10×18, 10×48 and 10×72 in., with a maximum distance of 24½ in. between centers.

The machines have live spindle diameters of 2 in. and 1⅝ in. respectively on the headstock, and dead spindle diameters of 1⅝ in. and 2 in. Individual motor drive is also provided for the table traverse, work spindle and coolant pump.

The truing device is mounted on the footstock, and after being set by hand is operated by the work table traversing the diamond across the face of the wheel. Spindle diameter of the footstock on both machines is 1⅞ in., and either lever or hydraulic operation can be provided.



Barnes' Two Spindle Deep Hole Boring Machine Bores Aircraft Cylinders and Landing Gear Struts

The two spindle deep hole cylinder boring machine developed by W. F. and John Barnes Co., Rockford, Ill., is being used extensively by the aircraft industry for boring large airplane landing gear struts and recoil cylinders to a maximum diameter of 14 in. The machine has a stroke of 12 ft. and a swing of 25 in. diameter, and can handle parts with a maximum length of 67 in.

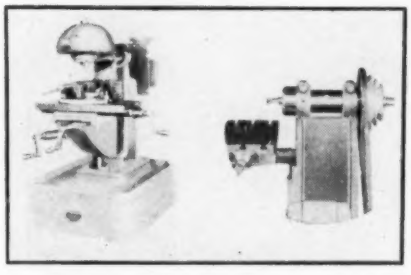
Two parts are bored simultaneously in independent cycles. Each work piece is driven by an independent headstock and supported by a separate adjustable, three-point roller steadyrests equipped with Timken roller bearings. The steadyrests have a screw adjustment from 5 in. minimum to 16 in. maximum diameter. The base of the machine is cast in two sections with three ways running full length. The head section has T-slots milled into the center way for clamping the headstocks, roller steadyrests, and tool guide bushing brackets to the ways.

The tools are fed by independent hydraulically actuated slides. The heads are fitted with spindles having a 6¼ in. hole and 15 in. lathe spindle nose with holes to suit 21 or 24 in. four-jaw independent chucks, or 21 or 24 in. three-jaw scroll chucks.

A rough V-locator moved by a hand crank incorporated into the steadyrests provides support for the work piece when loading and unloading, and prevents possible injury to the rollers or steadyrests. The top portion of the steadyrests are hinged to facilitate handling of the part.

The toolholders are bored for 6 in. diameter bar. The bar supports are positioned midway between the toolholders and the tool guide bushing brackets. The bar supports remain stationary until the toolholders have been fed forward to meet them. The bar supports are then carried along the ways until the boring cycle is completed. Two motor-driven hydraulic feed and traverse units mounted at the head end of the machine actuate the hydraulic feed cylinders mounted in the base.

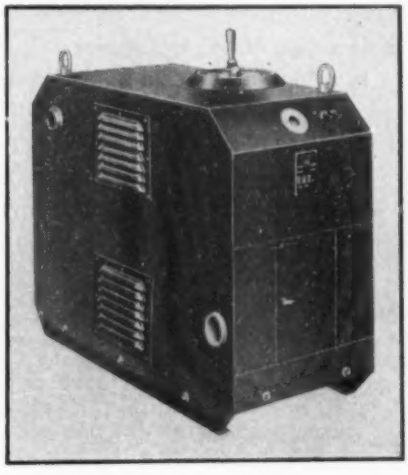
Spindle speeds of this machine range from 18 to 295 r.p.m. standard, or 4 to 60 r.p.m. optional. Each spindle and hydraulic feed may be completely controlled from either of the two push-button stations on corresponding sides of the machine. Either spindle or hydraulic unit may be stopped from any one of the four control stations. Each spindle has a high pressure coolant pump driven by a 15 hp. motor. Coolant is stored in the base and pumped through telescoping pipes at the sides of the machine, and to the tools through short lengths of flexible hose. Removable chip baskets and chip chutes are provided on the tool guide bushing brackets.



Benchmaster Vertical Miller Has Horizontal Attachment

Benchmaster Tool Co., 2952 West Pico, Los Angeles, Calif., has made available an improved vertical bench milling machine with a quick-change attachment for horizontal milling. The machine is 30 in. high, with a table measuring 6×15 in. which has three T-slots ⅜ in., 2 in. centers. Four spindle speeds are available on this machine, and rapid speed changes can be made.

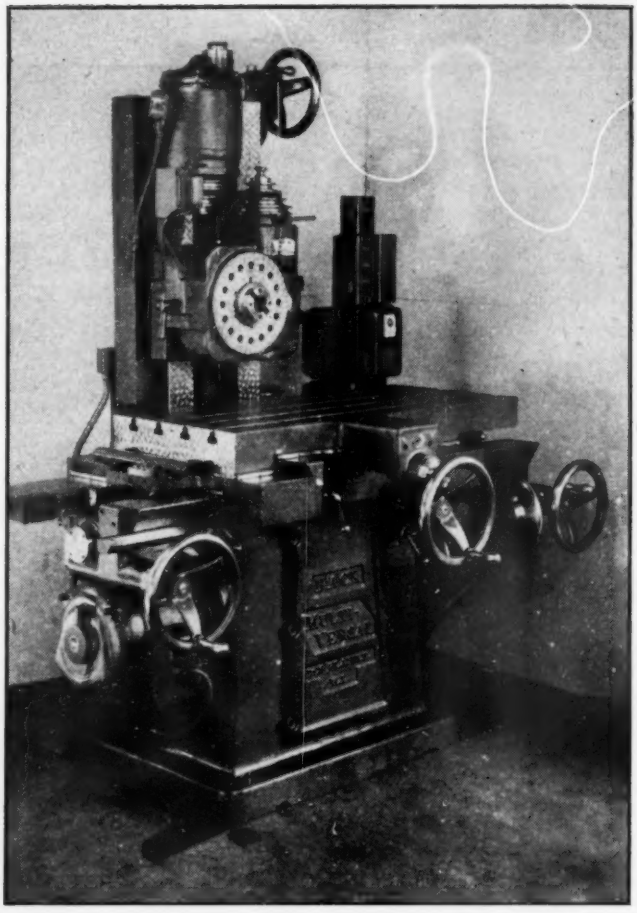
The 2½ in. diameter arm supporting the spindle head can be adjusted to rotate the spindle 60 deg. either side of the center. The entire head is easily removable for replacement with an enclosed horizontal milling attachment. Thus, a variety of jobs such as precision die making, die sinking, profiling, job boring, and key slotting can be handled on the machine. The spindle with a No. 2 Morse taper is enclosed for safety. A sturdy sub-base has been added for convenience of operation and for rigidity. The machine is driven by a 1/3 hp. motor.



Glenn-Roberts A.C. Welder Has Two Open Circuit Voltages

A heavy-duty transformer-type a.c. welder has been brought out by Glenn-Roberts Co., 1009 Fruitville Ave., Oakland, Calif., known as the G-R Model 49 machine. It has been built to handle continuous welding loads, incorporating an oversize core working at low flux densities. Two open circuit voltages give a wide variety of applications, particularly for the welding of heavy plate, within the output range of the machine of 100 to 675 amp.

The G-R Model 49 can be adapted from hand to automatic operation. The unit handles rod from ⅛ to ⅜ in. diameter, with the only required adjustment being a twist of the handwee!.



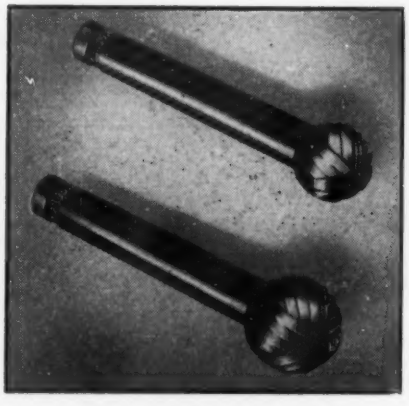
Carboloy Chip Breaker Grinder Is Adapted to Wide Tool Use

A carbide tool chip breaker grinder with greater flexibility and higher capacity has been developed by Carboloy Co., 11149 East Eight Mile Road, Detroit 32, Mich., to replace the former model. It is suited for the grinding of chip breakers in single point tools and roller turner tools, as well as being adapted to use for grinding flat form tools and round or square boring bits. This machine is equipped with a table which can handle tools up to 2 in. wide. The long table with 10¾ in. of travel makes possible the grinding of breakers in both right and left hand tools without moving the universal fixture on the table. The head, designed for the use of 6 in. wheels, is vertically adjustable from either side of the machine.

The grinder is provided with a universal fixture and vise for holding tools up to 1¼ in. wide, while a vise for tools up to 2 in. wide is available. To facilitate the grinding of chip breakers in roller turner tools, the universal fixture tips 90 deg. either side of horizontal, and the center of the fixture can be cross-fed 1 in. past the center of the wheel.

When grinding the top of small bits, the traverse mechanism can be changed from direct drive to slow speed through a 5 to 1 reduction.

The base of this chip breaker grinder is 29 in. high and contains storage space for tools and other equipment. The motor is single phase, 110 volt, 60 cycle, ¼ hp. Weight of the standard machine without the pedestal is 290 lb., and with it an additional 100 lb.



Carburs Burring Tools Supplied in Ball-End Types

Cemented-carbide burring tools have been placed on the market by Carbur, Inc., Lincoln Park 25, Mich., and are known as Carburs. They are supplied in ball-end types in ⅜ and ½ in. sizes. The shanks are 0.250 in. diameter, and the burring tools are 2½ in. over-all.

The cutting teeth are ground from the solid and the cemented-carbide heads are securely attached to the steel shanks. These tools have been designed to run at high speed.

Hack Multi-Versal Machine Handles Complicated Parts

The No. 10 heavy-duty Multi-Versal machine manufactured by Hack Machine Co., 1226-28 Harding Ave., Des Plaines, Ill., is suited for machining complicated shapes and angles, permitting a sequence of operation without removing the part from the table. The machine has a high-speed range suitable for jig boring as well as a low speed range with ample power to pull an 8-in. face mill.

Additional operations which can be performed on this machine include spiral milling, gear hobbing, universal boring bar work, form tool generating, internal and external thread milling.

Because of the reciprocating action of the rear ram, this machine is suited for both reciprocating and rotary cutting. When locked in position by nuts, the rear ram serves as a fixed column. It moves vertically from 0 to 4¾ in. at 80 strokes per min. The ram travels on hardened and ground rollers over dovetail ways.

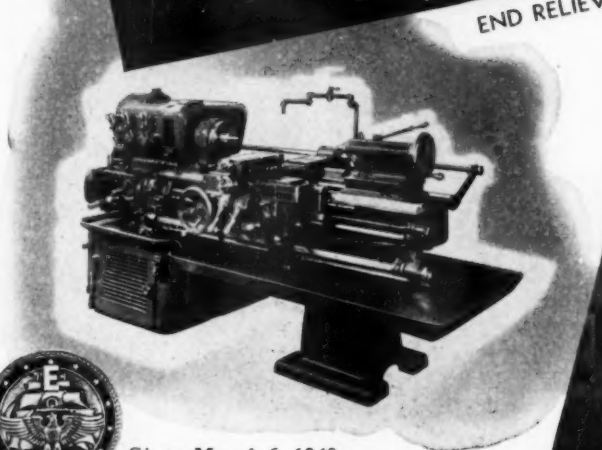
The master head has vertical power feed, and travels either with the ram or independent of it. This head is a self-contained horizontal milling unit, with eight back-geared feeds suitable for driving cutters ranging in size from a ¼ in. end mill to an 8 in. face mill. This master head can be elevated within the ram by means of hand or power feed. It serves as a carrier for all removable attachments.

Double Duty in YOUR TOOL ROOM

. . . with the Lodge & Shipley Universal Relieving Attachment . . .

All the usual jobs, PLUS the ability to do—end, internal, external, plain, angular, or spiral relieving work. Investigate these advantages.

END RELIEVING



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THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U.S.A.

ENGINE TOOL ROOM AUTOMATIC OIL COUNTRY LATHES

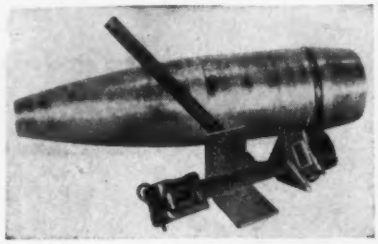
Sweetland Magnetic Clamp Positions Welded Parts

For positioning welded parts, Glenn-Roberts Co., 1009 Fruitvale Ave., Oakland, Calif., is making the Sweetland magnetic clamp, designed for shipyard use but applicable by adaptation to a wide variety of uses. The device is available in three models.

Models B and C consist of two magnetic units coupled together with a yoke and provided with vertical and horizontal adjustments. The yoke carries a handwheel and pressure screw. The Model B is composed of two 2-section magnets, exerts a pull of 3½ tons on ½ in. plate and weighs 210 lb.; while the Model C utilizes two, 3-section magnets and exerts a pull of 4½ to 5 tons on ½ in. plate, and weighs 300 lb. Model B is adapted for stiffeners 8 in. high or less, and the other models for girders up to 18 in.

Model HVC is composed of a 3-section horizontal magnet and a 1-section vertical magnet to hold the stiffener in a 90 deg. position. A Johnson bar is furnished with this model.

The clamp is of lightweight construction and is equipped with retractable ball bearing wheels working on a ball-bearing swivel. With the clamp stiffeners are positioned and held in place while the tack welds are made directly without the use of saddles, clips or other means requiring temporary welds. This reduces time and does away with chipping conserves materials, as well as avoids setting up stresses from temporary welds. A 12 amp. rectifier is available to rectify alternating current and supply power for use with the clamp. A motor-generator set may also be used.



Cunningham Box Type Holder Marks End and Side of Shell

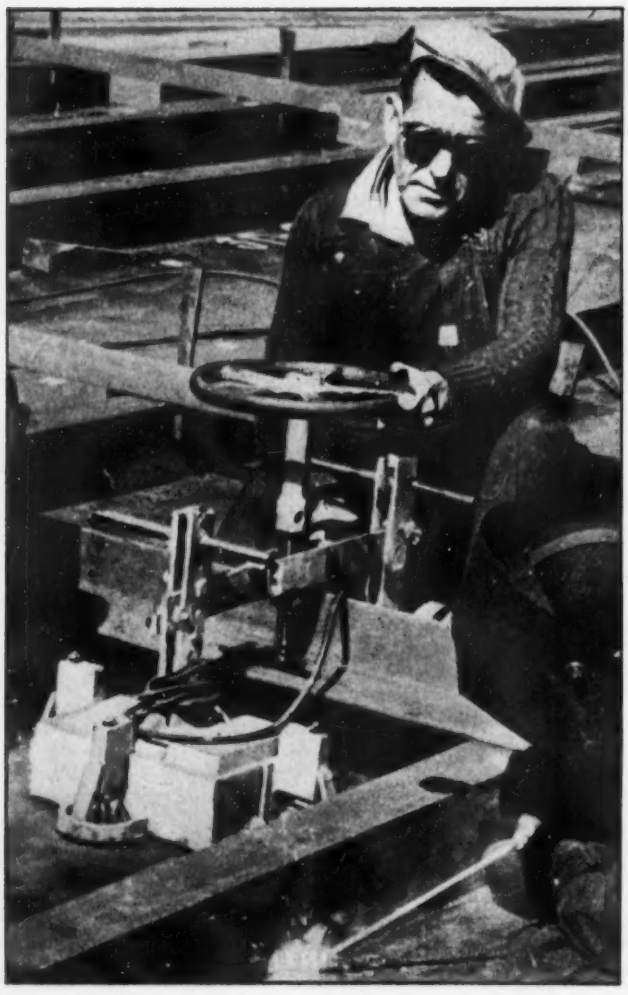
For stamping identification marks on the end and side of semi-finished 155 mm. shell forgings in one operation, M. E. Cunningham Co., 115 East Carson St., Pittsburgh 19, Pa., is offering the dual-purpose box type holder. Guide plates level both type holders to assure clear, uniform markings. By eliminating the usual separate handling required for each marking, this holder reduces the marking costs considerably, according to the maker.

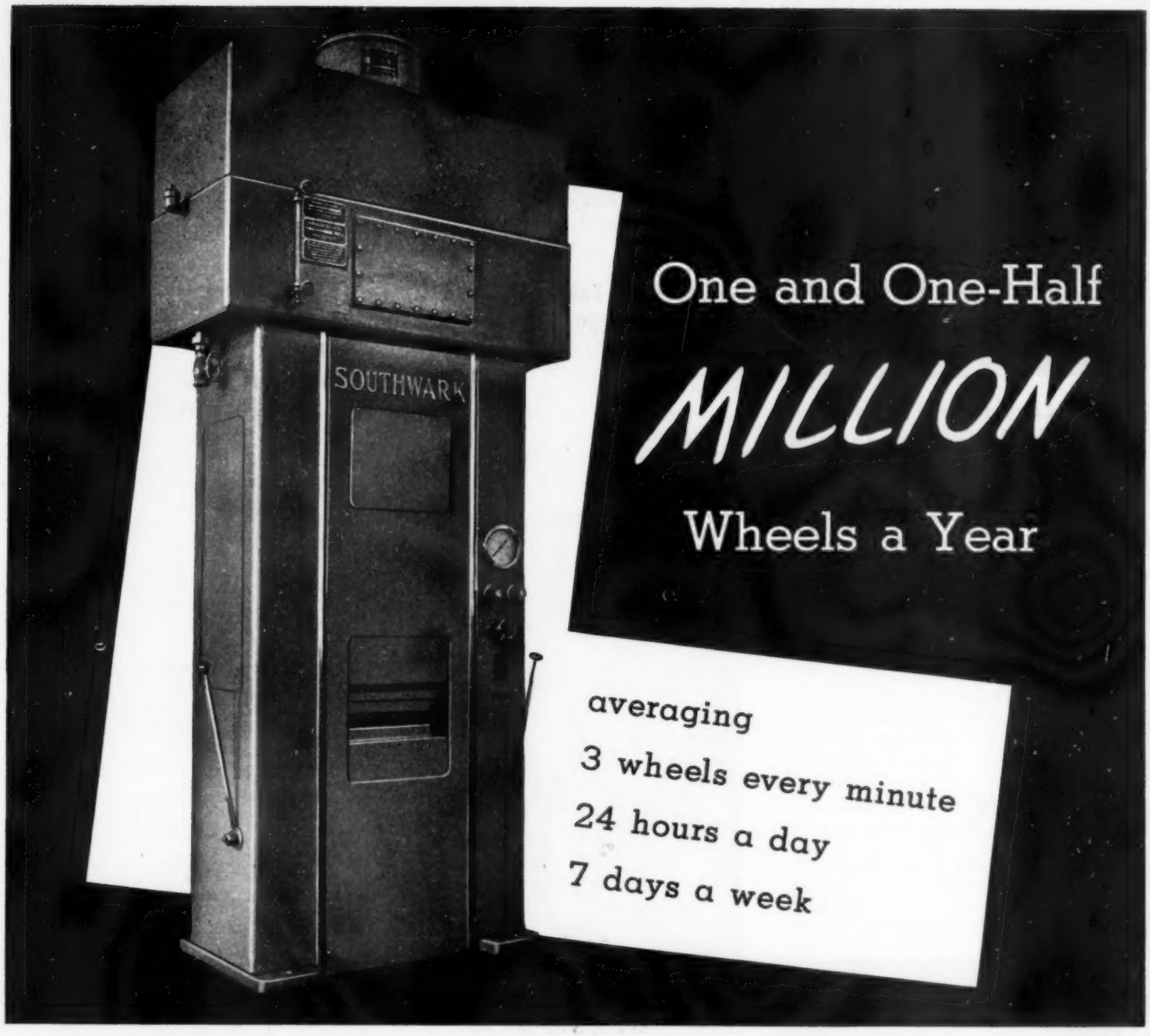
Phoenix Limit Snap Gage Has Double Cone Lock Plugs

A feature of the adjustable limit snap gage, produced by Phoenix Gage Co., Phoenix, N. Y., is the locking device. Two plugs, each having two flat surfaces, are located at an angle to each other along the body. These plugs are placed in the set position by adjusting screws which are made in the form of a double cone eccentric. The gage is available in 34 sizes, with the first size arranged from 0 to ⅛ in. and the largest arranged from 11 to 12 in. Those 7 in. and over are furnished with square head gaging pins on both sides.

The frame of the gage is made of soft gray iron casting normalized to prevent distortion in changing temperature, and is furnished in black crackle. The faces of the plugs are large, ground and lapped parallel to each other. The edges are round to prevent injury to the work. Two flat surfaces of the plugs help to prevent the plugs from turning.

To adjust the gage, the cams are unlocked with a screwdriver by turning to the left until the desired size is obtained. Locking of the plugs is accomplished by turning the cam clockwise, locking the plugs for end movement and bringing them to bear against the adjusting screw.





with a **Baldwin Southwark** 130-ton grinding wheel press

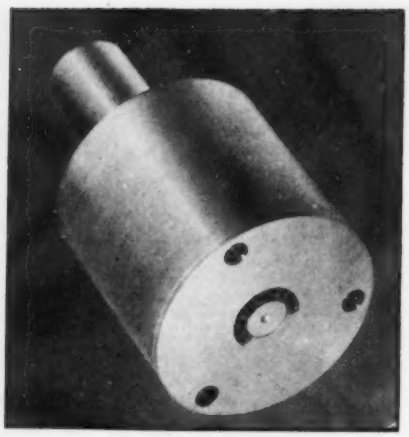
Here is a typical example of proven performance. Installed four years ago at what is now an important war plant, this Southwark 130-ton self-contained, oil-operated grinding wheel press is doing a bang-up war time job—one and one-half million wheels a year—to the extreme satisfaction of the owner and his customer.

You, too, can set up similar production records and thereby command your markets with well designed, soundly constructed Southwark presses. Write for Bulletin No. 160 today.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco.

BLW THE BALDWIN GROUP **BALDWIN SOUTHWARK**

Division **THE BALDWIN LOCOMOTIVE WORKS,** *Philadelphia, Pa.*

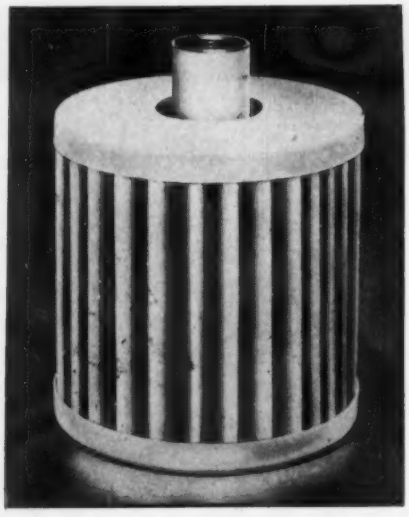


Force Circular Type Holder Marks Different Curvatures

A circular type holder for marking flat, circular pieces on a variety of radii can be furnished by Wm. A. Force Co., 216 Nichols Ave., Brooklyn 8, N. Y. The holder is fitted with individual spacer rings and retainers, permitting it to be used for marking pieces of different curvature. By removing the retainer plate and pulling out the inside recess rings, changes can be quickly made from one curvature to another. All parts are interchangeable in the one holder. A single flange type is usable with the other parts for marking on any of the various radii.

Staynew Sump Type Filter Protects Pump From Cuttings

The Model SE sump type liquid filter made by Steynew Filter Corp., 11 Centre Park, Rochester, N. Y., fits on the end of pump suction lines and is sub-



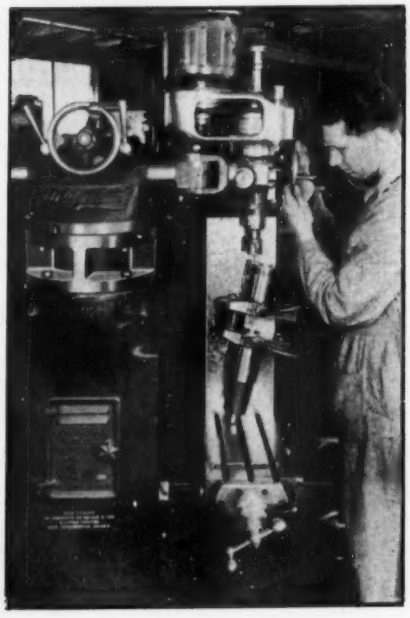
merged in the settling basin or sump for protecting the pump from abrasive particles.

The filter insert is capable of handling liquids of relatively high viscosity carrying heavy concentrations of metal cuttings and abrasive particles. This unit is particularly adapted to filtering sulphurized and straight mineral oil and water soluble oils used as coolants. The material is preformed in a radial fin shape and slipped over a heavy shaped mesh supporting form. This design permits expansion of the insert like a bellows so that accumulated material may be washed and restored to original condition.

This filter is available in sizes to fit pipe sizes from ½ to 2 in., and can be furnished in diameters from 4½ to 12¼ in. over-all heights from 3 to 11 in.

Hoover-Riser Enlarges Capacity Of Bridgeport Vertical Miller

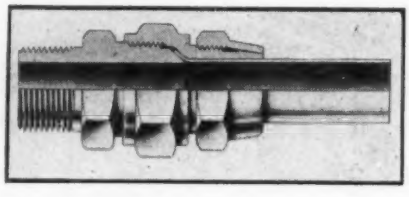
The Hoover-Riser has been built by Hoover Tool Die Co., Detroit, Mich., to fit the standard Bridgeport milling machine to handle bulk work which requires a light cut. It increases the over-all capacity of this machine 6 in. The unit is made of gray iron casting,



recessed and drilled to fit this machine and is bolted in place, thus becoming an integral part of the milling machine. It provides a quick means of handling work that would ordinarily tie up a large machine.

Cotner-Wilkinson Fitting Has Collet Nut Connection

Industrial and hydraulic tube fittings made by Cotner-Wilkinson Co., Logansport, Ind., provide a connection which does not require threading, welding or soldering. The double nut series is made in many models for tube sizes ranging from ¼ to 2 in., while the single nut series is suitable for tube



sizes ranging from ¼ to 1 in. inclusive.

The compression nut compresses the collet nut to the tubing and provides a firm collet-like grip which does not loosen under vibration or shock from the hydraulic system. This compression nut also compensates for any variation in the outside diameter of the tubing. The collet nut, with long bearing surfaces, grips the tube securely without damage.

The single nut series retains all the features of the double nut, but is simplified for close work, and is particularly adaptable for installations where space is limited.

Lyon-Raymond Elevating Table Is Made With a Swivel Top

Several improvements in the hydraulic elevating table for dies and weldments made by Lyon-Raymond Corp., 1211 Madison St., Greene, N. Y., extend the adaptability of this model. It is made in the portable type with two stationary, and two swivel casters, with single speed hydraulic foot pump. The table top is 30 in. square and has a lowered height of 29 in., and an elevated height of 43 in., with an elevation of 14 in. The table swivels but may be locked in one position.

The table can be furnished with seven different optional features: Floor

lock to keep it from moving on the casters; spring balanced towing handle; locking device which allows the table top to be turned and locked 15 deg. throughout the circumference; collapsible retaining bars for the table sides to hold the work on the table; four swivel casters instead of two swivel and two stationary casters; a stationary type; and a two-speed hydraulic pump.

Wolfe-Kote Makes Rust Remover And Invisible Rustproofing Oil

For rustproofing painted or unpainted metal Wolfe-Kote Co., Sheboygan, Wis., has produced Irpo, an invisible rustproofing oil. Applied to the metal surface by spray, brush or cloth, it requires only a light application and is hardly visible. It is said to be im-

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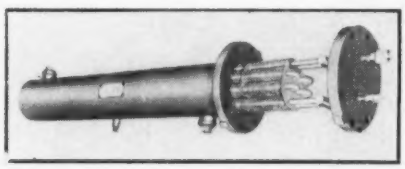
pervious to weather conditions and salt spray.

The company also has available Krome-Kote, a liquid sheet metal cleaner for removing rust and grease on parts that are to be painted, lacquered or varnished. It also serves to protect against rust from reforming on the surface. This material is non-inflammable; and the boiling point of the solvent used in it is 310 F. Because of the high boiling point of the solvent, the material may be heated or applied to the metal while hot. Krome-Kote is a concentrate and packed in 1 gal. size.

Kramer Trenton Coolant Cooler Is Shell and Fin Tube Type

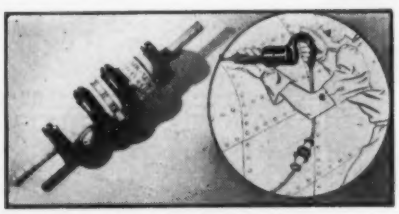
The coolant cooler brought out by Kramer Trenton Co., Trenton 5, N. J. is designed for use with water, brine or direct expansion refrigerant. This cooler is of the shell and fin tube type, and consists of a spiral fin cooling coil inserted into a steel shell. The unit is provided with a bolted flanged lid for removing the coil for cleaning



purposes. The coolant circulates at proper velocity by means of suitably spaced baffles.

The lines and unit insulation require insulation if the coolant temperature is held below the room temperature. If the coolant is held above room temperature, no insulation is required.

The cooler can be furnished with brackets which can be used for floor, wall or ceiling mounting.



Air-Lube Lubricator for Tools Eliminates Frequent Oiling

The Air-Lube lubricator, made by Filters, Inc., 1515 Gardena Ave., Glendale, Calif., is suited for feeding a regulated oil mist into air tools to eliminate the need for frequent daily oiling. This lightweight lubricator is recommended for use in air hose from 1 to 6 ft. from the tool, or may be used in air pipes for larger air-driven stationary or semi-portable tools. It is also adaptable for air passages in a machine. Positive feeding action provides a regulated amount of oil, and feeds only when the tool is operating.

The oil reservoir holds enough oil for more than a week under normal usage. Regulated wicking action with an automatic shut-off prevents flooding of air tools with oil.

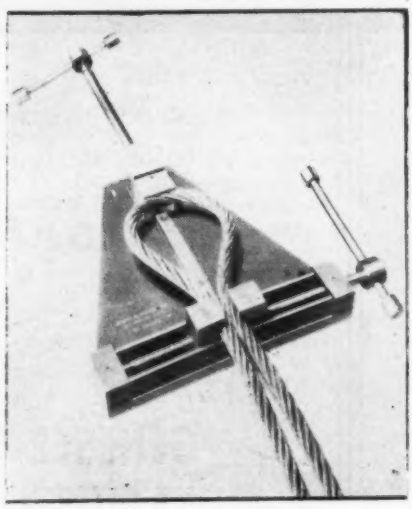
Palmer-Shile Bar Stock Sling Handles Loads up to One Ton

To facilitate the handling of bar stock, rods, angle iron, heavy tubing and similar materials, Palmer-Shile Co., 780 South Harrington, Detroit, Mich., has developed a bar stock sling which is strongly braced and reinforced. The

sling measures 5 ft. in length and the cradle is 10 in. wide and 8 in. high. The unit weighs about 50 lb., and the sling takes care of any load up to 2,000 lb.

Patrick-McDermott Makes Vise To Handle Wire Rope and Cable

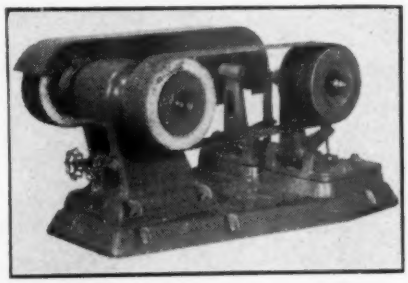
A development of Patrick-McDermott & Co., 1645 East Slauson, Los Angeles, Calif., is the rigger's portable forming vise that handles wire rope and cable from ⅜ to 1¼ in. diameter without adapters. Splicing and clamping operations as well as the forming of cable into an eye or around a thimble are easily handled. The vise is equipped with guards to protect against cable and thread friction. It weighs about 50 lb. The base measures 14 in. wide and 15 in. long.



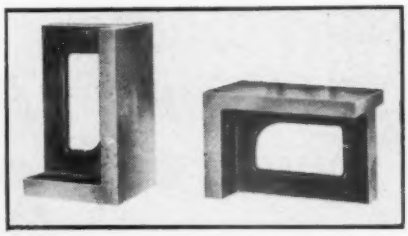
Jones Grinder and Polisher Used for Any Type Grinding

The bench grinder and polishing machine No. 135 offered by Jones Engineering Co., Ellwood City, Pa., is adaptable to any type of grinding and finishing of flat pieces and irregular shaped parts. It is mounted on a one-piece base and has precision ball bearing construction throughout. This grinder may be used with any ¾ to 2 hp. motor which fits underneath the bench.

Endless abrasive belts are used in this model. An adjustment spring tension device on the idler pulley main-



tains belt tension. Controls for belt alignment are located at the front of the unit. This grinder is equipped with a cushioned, segment face contact wheel, and uses sharp, fast-cutting, coated abrasive belts.



Challenge Right Angle Iron Made in Four Size Ranges

A universal right angle iron has been provided by Challange Machinery Co., Grand Haven, Mich., for measuring work, and is furnished in four sizes ranging from 4 to 8, 5 to 10 and 3¾ to 5½ in. on each side. The blocks may be placed in almost any position with the work clamped to the face for measuring.

These irons are made of heat-treated semi-steel. An opening in the rib provides a convenient hand grip. In measuring large work, the right angle irons may be used also as height blocks.

Wolfe-Kote Offers Anti-Spatter For Application to Weld Seams

Anti-Spatter is offered by Wolfe-Kote Co., Sheboygan, Wis., for application to a weld seam to prevent diffusion of spatter or molten metal to the surface of the metal surrounding the weld. It is applied by brush and can be used a considerable length of time before the job is done, and removed

Why Does a Cutting Fluid Work?

A statement of tremendous importance to all interested in metal machining

TO DEVELOP NEW and greatly improved types of cutting fluids—made possible by increased knowledge of the chemical and physical functions of such materials—has been the aim of Quaker Chemical Products Corporation ever since we were convinced that the current knowledge of such products was, and still is, in its infancy.

Much has been written about fatty oils, sulphurized fatty oils, sulphurized mineral oils, chlorinated fatty oils and mixtures of all of these. But a close study shows many inconsistencies and a lack of definite *knowledge*. A great many statements made were based upon *theory* . . . or intelligent guesses.

So, some years ago we set aside a portion of our research laboratory, picked three outstanding men from our own research staff and assigned to them the task of replacing these theories and guesses with definite scientific knowledge.

Obviously, if we could find out just exactly what is needed to lubricate and cool a cutting tool and could measure this in the laboratory, the entire field would progress by leaps and bounds. Naturally, we have not yet learned all the answers . . . nor can we yet effectively measure in the laboratory just what a cutting fluid will do in practice . . . but we *have* taken many long steps toward our ultimate goal.

Sulphurized . . . But How?

When harder steels, tougher cuts and higher speeds made it necessary to improve the quality of mineral lard oil, the addition of sulphur constituted the first real advance. A little later sulphur was cooked into a combination of mineral, animal and vegetable oils. These sulphurized fatty-mineral oil combinations turned out cooler and better work than mineral lard oils or plain sulphurized mineral oil.

But our laboratory studies opened up another important angle. It soon became evident that it wasn't only the *amount of sulphur* or the *kind of fat sulphurized* that determined results. **The sulphur must be combined in just the right way, so that it will be *released gradually* . . . only to the extent required to prevent metal-to-metal contact . . . otherwise the sulphur content of the oil is rapidly exhausted and tool life is materially shortened.**

Thus, it is not sufficient to distinguish between "free", "combined" and "active" sulphur in cutting oils. The *rate of release* of the combined sulphur is of principal importance and can be determined only by practical machining tests . . . and not by any of the laboratory methods, such as the copper test, now in vogue.

New Process of Polymerization Found Effective

Further research in methods of combining sulphur led us into the treatment of fats and fatty waxes not heretofore used in cutting fluids. These were treated differently —by *polymerization* or a building up of the molecules. Next we found that *high pressure* and the use of a *catalyst* gave even better results. **Finally our laboratory succeeded in producing a sulphurized, polymerized fatty wax which not only permits the sulphur to be released over an extended period of time but which also possesses extreme pressure properties as well as excellent lubricating, cooling and anti-weld qualities.**

What This New Type Product Does

Primarily, this new material is a "base". That is, it is a concentrated product that must be blended with a vehicle such as ordinary mineral oil. When diluted in this manner, this advanced type of cutting fluid replaces present types of ordinary sulphurized cutting oils.

Numerous reports in our files attest to the considerably increased production being achieved in many plants with this new product which makes possible greater speeds and feeds . . . with longer runs between tool changes. On a difficult cutting operation where tools are being changed once or even twice during an eight-hour shift, it is quite common for a **Quaker Process Engineer** to put this new product on the job and entirely *eliminate* these tool changes *during* shifts . . . enabling them to be made *between* shifts only. This often means a saving of almost an hour per machine per shift. Think what this can mean both in the saving of hard-to-get tools and also in terms of increased production of parts for the planes, guns and tanks needed to speed the day of Victory!

Production Data Available

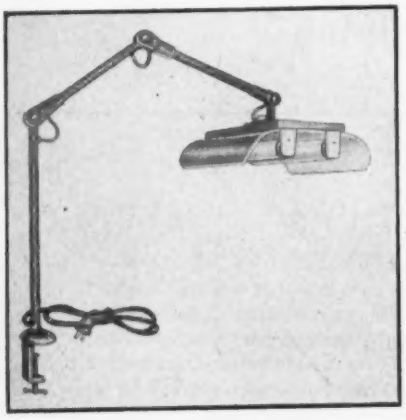
Authentic plant production data sheets containing complete figures on various machining operations with this new cutting base are available on request. They are actual reports from **Quaker Process Engineers** in the field and contain no advertising or "sales talk".

If you care to know more about how this new product can be of value to you, we suggest that you have a talk with a Quaker Process Engineer. These men speak your language and know how to translate our new developments into increased production in your plant. Please don't confuse them with ordinary salesmen—for before they came with us these men "cut their eye teeth" as factory chemists, metallurgists, methods engineers, or superintendents of industries such as yours. They are familiar with production problems—they deal with known facts—and they speak with authority. If you'd like to talk shop with such a man, write or wire us today.

QUAKER CHEMICAL PRODUCTS CORP.

CONSHOHOCKEN, PA.

any time after the weld is completed. This material has a wax base and is water soluble. Weld rust is said to be practically eliminated. Anti-spatter can be removed with a wet cloth as well as a dry one. It has a tendency to rust-proof the surface surrounding the weld.



Fostoria Lighting Fixture Equipped With Adjustable Arm

A fluorescent lighting fixture with a flexible arm has been designed by Fostoria Pressed Steel Corp., Fostoria, Ohio, which accommodates two 14 watt lamps. It is equipped with a lamp ballast and is completely wired with a switch mounted on top of the housing. The reflector is made of non-metallic material and measures 15×9×5⅝ in. The FLB reflector head of this model weighs 3 lb. The outside finish of the unit is wrinkle gray, and the inside reflector has a gloss white finish. A variety of arm lengths are available for positioning requirements.

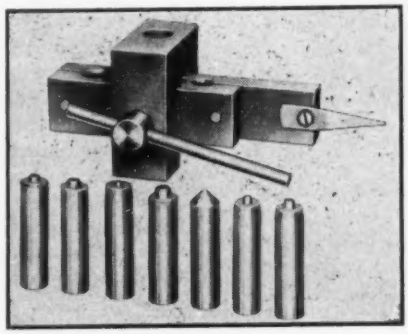
Wheel Trueing Dressing Tool Shaped for Angle Dressing

Wheel Trueing Tool Co., 3200 West Davison, Detroit, Mich., has produced a diamond dressing tool for thread grinding operations which is shaped to permit not only straight dressing, but angle, radial and multiple form dressing as well. The smaller size is approximately 1 in. long, while the others are about 1½ in. This precision diamond tool may be used for dressing the wheels that grind Whitworth, buttress, Acme or other standard or special threads.

Flaremaster Flaring Tool Makes Double Lap on Tubing

The Flaremaster heavy-duty portable flaring tool made by Everhot Products Co., 2055-59 West Carroll Ave., Chicago 12, Ill., is designed to produce a double-lap flare on steel and non-ferrous tubing in sizes ⅛ to ⅝ in. outside diameter. It produces a 45 deg. double-lap flare for SAE flare type and inverted flare type connections on Bundy, Bundyweld, and Bundyflex steel tubing, as well as on aluminum, copper, monel and similar tubing.

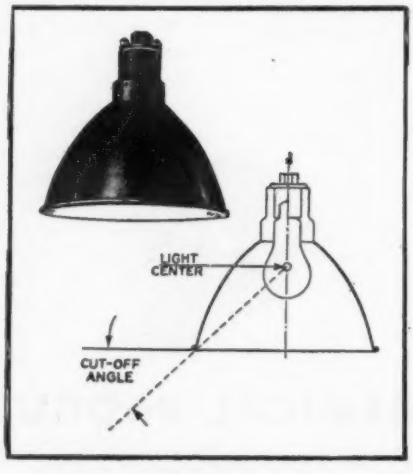
The tool consists of a pair of hold-

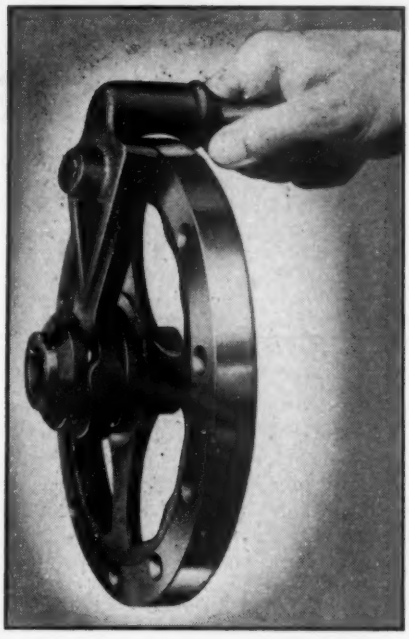


ing jaws, and a U-shaped clamp with a built-in vise. It can be used anywhere and does not require special wrenches. All wearing parts and punches are made of hardened steel, and jaws are counterbored to provide exact length of tubing to insure correct double flaring for each size.

Steber Deep Bowl Reflectors Confine Light Rays to Work

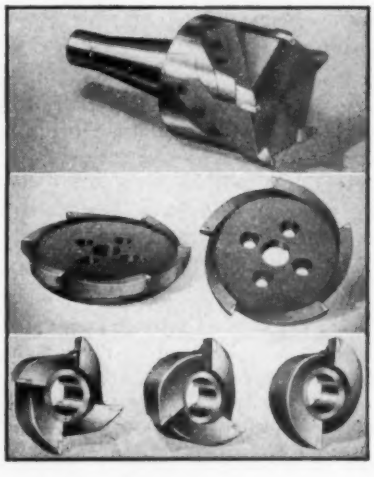
Deep bowl reflectors are being produced by Steber Manufacturing Co., 2451 North Sacramento Ave., Chicago, Ill., to confine and direct light rays directly on the work. These reflectors are made in four diameter sizes, 7½, 10½, 15 and 17½ in. The shade holder types are made in several sizes for use with 60 to 200 watt lamps, and the detachable socket type are for use with 60 to 1,500 watt lamps. The standard finishes are green for the exterior and white for the interior, either ultra-namel, or porcelain enamel.





Gibbons Safety Handle Wheel Suits Rapid Traverse Machines

The Safety handle wheel made by Gibbons Manufacturing Co., 11 Gordon St., Worcester 4, Mass., is especially recommended for rapid traverse machines where handle wheels or cranks are in fast motion. The handle is designed to prevent striking or catching of the operator's clothing while the wheel is in motion. Because the handwheel is keyed to the shaft, the wheel can be used without the handle.



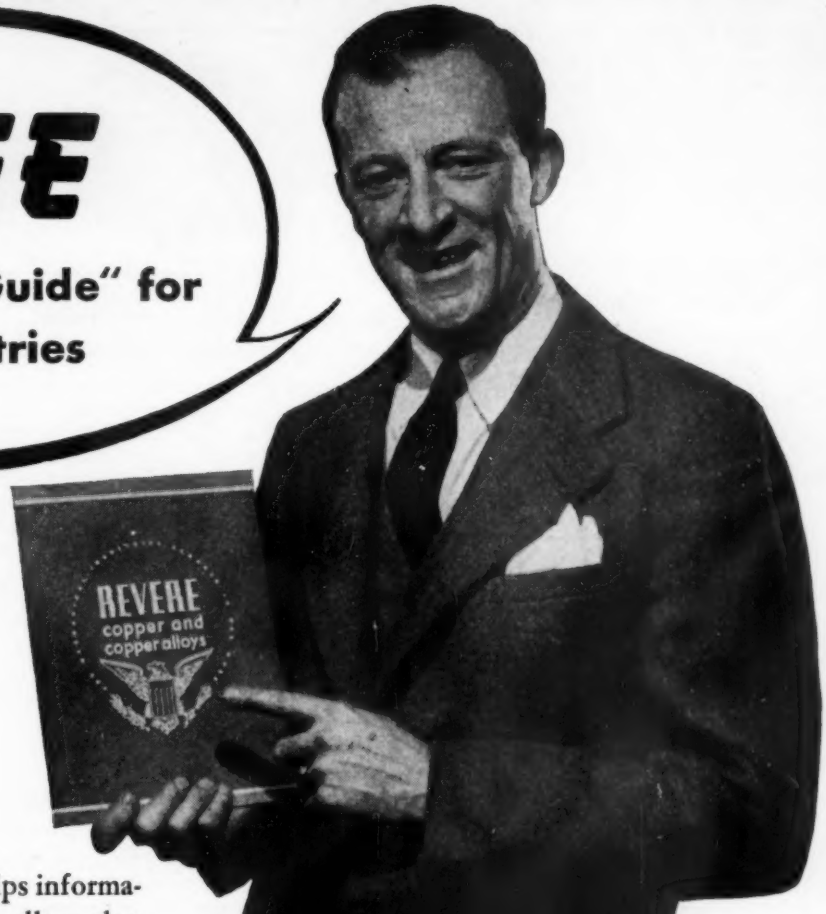
Cal-Cutters in Many Styles Are Made With Carbide Tips

Machinery Manufacturing Co., 1915 East 51 St., Los Angeles, Calif., is now making carbide-tipped milling cutters of many types and sizes under the name of Cal-Cutters which are suited for milling cast iron, cold rolled steel, heat-treated steel, aluminum.

Cutter styles include end mills, staggered tooth mills, shell end mills, standard and heavy-duty face mills, hyper mills, half-side mills, slitting saws, and interlocking cutters. In

FREE

New "Copper Guide" for war industries



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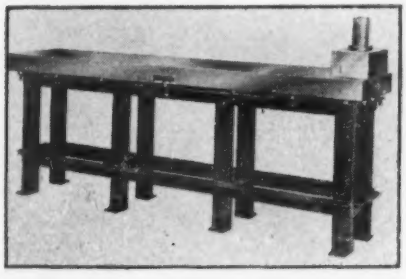
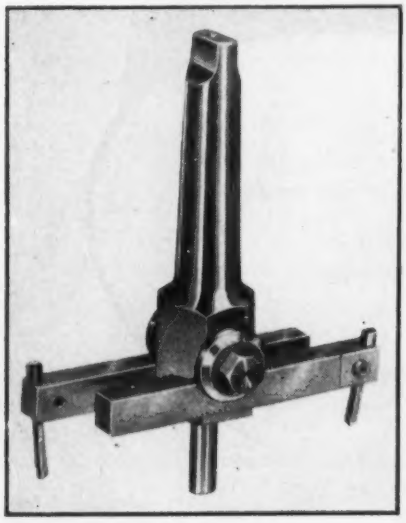
the "bore face" and "adjustable face and step mill" types, the cutters are adjustable for radius, the cutters being wedge clamped in the former and available with 2, 3 or 5 tips. The adjustable face and step mill has four or six tips in two models, each tip being controlled by a micrometer screw.

Challenge Long Surface Plate Equipped with Special V-Blocks

A long layout surface plate, equipped with special V-blocks is being offered by Challenge Machinery Co., Grand Haven, Mich. On order large surface plates will be furnished grooved and keyed so that two or more can be assembled and mounted into a complete

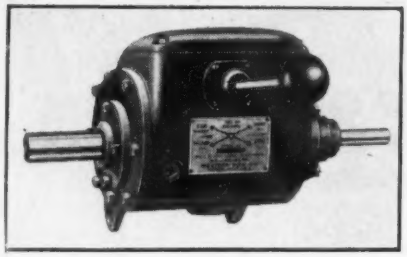


unit measuring as large as 108 × 288 in. One V-block is permanently anchored to the table and another is mounted in a T-slot allowing adjustment to any desired position along the table top on which it is mounted.



Clark Two-Blade Fly Cutter Cuts Holes Up to 1 In. Thick

Robert H. Clark Co., 3434 Sunset Blvd., Los Angeles 26, Calif., has brought out the two-blade adjustable fly cutter for cutting holes or disks in metals of thicknesses up to 1 in. The tool provides ample clearance between the work and the body of the fly cutter, making possible deeper cuts with less strain on the tool. The bit in this tool can be easily reground or replaced with a new one.



Western Makes Transmissions In Left-Hand Output Models

Left-hand output models of the Master and Major transmissions have been made by Western Manufacturing Co., 3400 Scotten Ave., Detroit, Mich., which make them more adaptable to motorizing of cone driven machine tools. The Master is a 1 to 5 hp. unit, while the Major is a 5 to 10 hp. transmission.

Multi-Motor-Mounts are available in three models, one for such machines as lathes, automatics, vertical milling machines, another for shapers, boring mills, slotters, and one for milling machines.

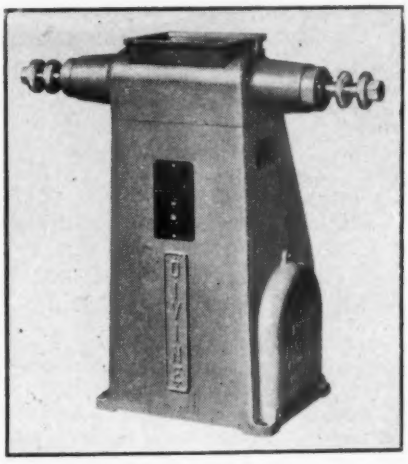
Macwhyte Level-Lift Sling Has Automatic Equalizer

The Level-Lift sling built by Macwhyte Co., Kenosha, Wis., equalizes itself automatically as the crane operator applies power to hoist the load. The Type CSE sling handles three tons with the single unit, and six tons with the double unit.

The sling is furnished with ½ in. wire rope in any length required. This rope operates through a block mounted on the crane hook. The equalizing feature consists of a floating sheave or drum, having a braking action to arrest the leg adjustment after the load is lifted. In operation, it is only necessary to spot the crank hook over the approximate center of gravity and attach the sling to the load. As the power is applied to lift the load, the rope adjusts itself automatically.

Divine Light-Duty Lathe For Small Parts Polishing

The VJ light-duty lathe for small parts polishing and burring, offered by Divine Brothers Co., Utica, N. Y., is available with motor sizes up to 3 hp. and spindle speed range to a maximum of

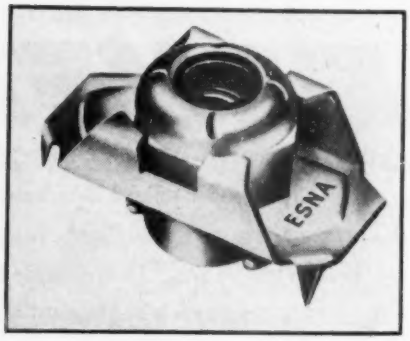


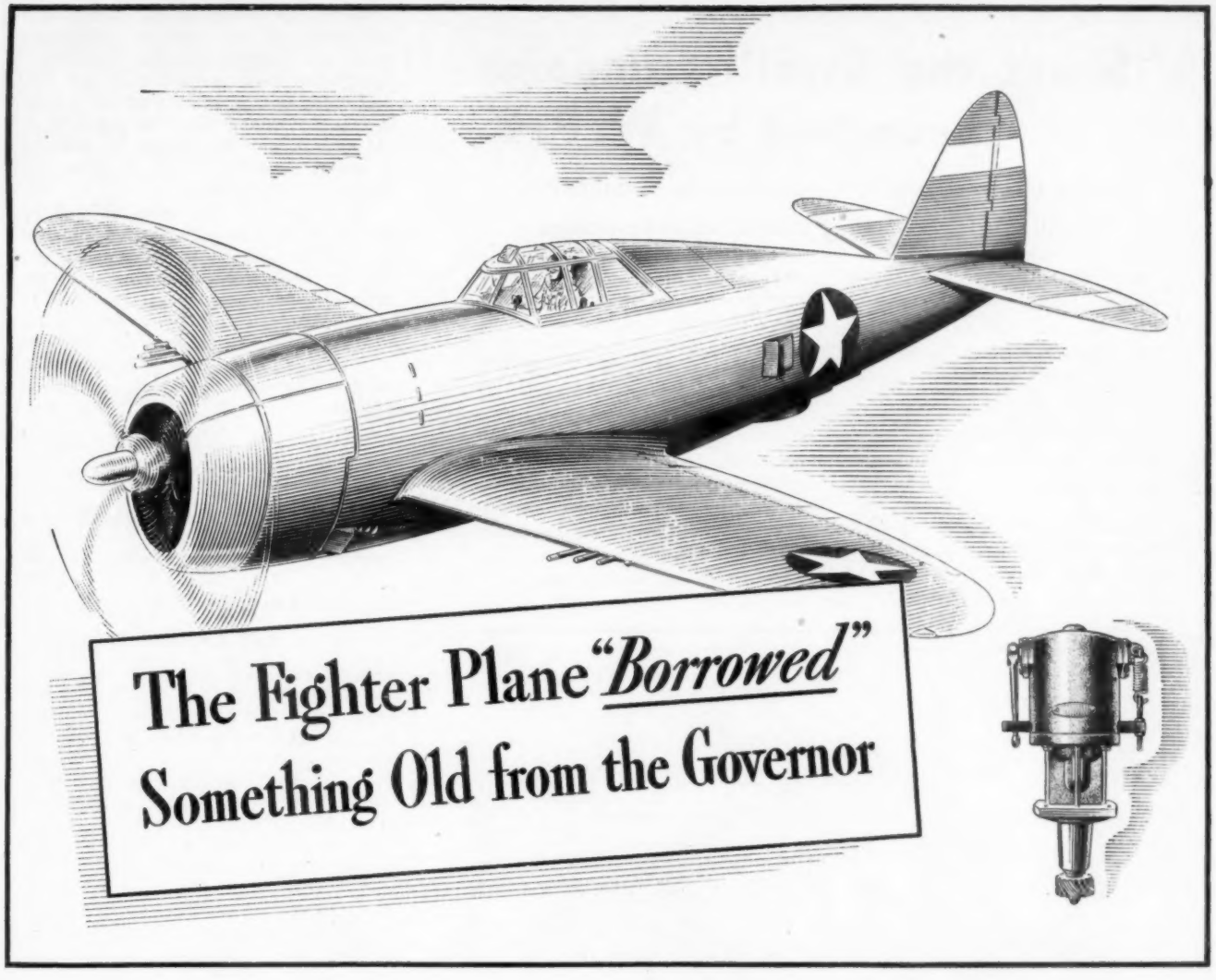
3,850 r.p.m. The base of the machine measures 22×17½ in., and the distance between the wheels is 36½ in. The unit weighs 620 lb.

The spindle is V-belt driven from a standard motor, and an adjustable motor base provides means for the belt adjustment. The over-all length of the spindle is 44 in. for wheels up to 2 in. wide. Standard spindle diameter is 1¼ in., with 4 in. flanges. The machine is equipped with two sealed-for-life spindle bearings. The pushbutton starter is equipped with thermal overload relays for motor protection.

Elastic Stop Nut Fastener Developed for Plywood Use

A self-locking fastening device for use on plywood has been developed by Elastic Stop Nut Corp. of America, 2332 Vauxhall Road, Union, N. J. The stop nut, with its red cellulose locking collar, is locked in a lightweight basket which anchors firmly in the wood





The Fighter Plane "*Borrowed*" Something Old from the Governor

IT MAY BE surprising to learn of vehicle engine governors having something in common with modern combat planes. In governor design, the problem was one of space limitations...and, of course, precision. So designers selected the Torrington Needle Bearing since it combined, happily, the necessary small size with a friction coefficient low enough to assure a high degree of accuracy in governor operation.

Builders of fighter planes, on the other hand, were confronted with an entirely different set of problems. A bearing for manual control mechanisms must not only conserve space and weight, but respond instantly—time after time. Yet strangely, or perhaps not so strangely, military aircraft manufacturers found what they, too, were looking for in the Needle Bearing. And other features as well, which came in mighty handy as the war took increasingly to the air.

In addition to this unique anti-friction bearing's compact design there was its effective lubrication, which helps keep 'em flying miles and often whole continents from maintenance stations... high unit capacity, meeting the rigid load and weight requirements of these fast, maneuverable aircraft... ease of operation, giving our pilots one more important edge in aerial combat...and ready availability—a vital factor helping to maintain and speed up our plane production.

NEEDLE BEARINGS— ALL TYPES—ALL SIZES

NEEDLE BEARINGS TYPE DC are complete, self-contained units consisting of a full complement of rollers and a drawn, hardened outer race. They offer the advantages of small size, low cost, high capacity—and easy installation.

NEEDLE BEARINGS TYPE NCS consist of a full complement of rollers and a relatively heavy hardened outer race. They are furnished with or without inner races. Needle Bearings Type NCS are adaptable to heavier loads than Needle Bearings Type DC.

NEEDLE ROLLERS TYPE LN are produced in a range of types and sizes for assembly on the job into low-cost, high-capacity, anti-friction bearing units. Our engineering department will be glad to advise on the correct size and type for any application.

DOES THIS SUGGEST TO YOU POSSIBILITIES for adapting the Needle Bearing to your postwar designs? The people you serve are going to want, in their own products after Victory, the revolutionary principles that have improved performance and cut costs in war production. And the Needle Bearing offers all of them—light weight, compact design, infrequent lubrication, dependable operation, plus installation ease unique in an anti-friction bearing. For preliminary information, write for Catalog No. 105, which lists sizes, ratings and typical applications. Then let Torrington engineers help you work out whatever specific service problems may develop.

THE TORRINGTON COMPANY

Established 1866 • Torrington, Conn. • South Bend, Ind.

Makers of Needle Bearings and Needle Bearing Rollers

New York · Boston · Philadelphia
Detroit · Cleveland · Seattle
San Francisco · Chicago · Los Angeles
Toronto · London, England

LET'S GO! WAR BONDS KEEP 'EM FLYING

TORRINGTON NEEDLE BEARINGS

Advertisement

"Share the Steel" Campaign Launched by W. P. B.

Steel Users Asked to Cooperate in Eliminating Duplicate Stocks and Reducing Inventories

The Steel Division of the War Production Board, working thru its 12 Regional Offices, is urging manufacturers to defer or eliminate third and fourth quarter orders on producers books as far as possible, without interfering with the production of important war equipment.

They hope, thru this plan, to cut inventories, reduce the tonnage of vital steel and make it possible to furnish 2,000,000 tons of steel to other manufacturers and government agencies that are not sufficiently supplied.

The steel warehouse distributors throughout the country such as Joseph T. Ryerson & Son, Inc., make it not only safe, but practical, to reduce the over-all tonnage of idle steel. These steel-service plants, with long experience in stocking, cutting and shipping, have served this very purpose throughout the history of our country.

CONCERNING

Wartime Vacations

The terrific pace of war production continues—and with metals still on the critical list—men who buy are under greatest pressure. But brief periods of mental relaxation are still essential to health and efficiency. So, in the interest of your country, your company, your family and yourself—you should take some time off this summer.

True, travel is restricted. The boys in the Service have priority on transportation and God bless them. But a happy vacation really doesn't depend on distance—so plan ahead—leave your worries behind and soak up some good old sunshine.

And—as far as steel is concerned—tell your men to depend on Ryerson. Our stocks are still the most complete. And where war requirements have created some shortages, we can usually offer substitutes that will do the job as well.

So go ahead—enjoy yourself. *Joseph T. Ryerson & Son, Inc., Chicago, Milwaukee, Cincinnati, St. Louis, Detroit, Cleveland, Buffalo, Boston, Philadelphia, Jersey City.*

RYERSON

Four prongs at the corner of the basket sink into the surface of the plywood, and two feet inserted in the hole are forced into the wood as the nut descends. Spring fingers at the top of the basket clasp the nut after it is seated. It can be driven in with a hammer, forced in with a press, or drawn in with a bolt.

After the nut has been applied to the surface, it is held against turning by four prongs on the corner of the washer plate, and also by the feet pressed into the sides of the hole. It is suited for use on plywood from ⅛ in. up. The nut is replaceable without moving the basket, and 8/32 and 10/32 nuts are interchangeable in the same basket.

NEW MATERIALS

Formica Develops Pregwood For Airplane Propellers

Pregwood, which has been developed by Formica Insulation Co., Cincinnati, Ohio, especially for airplane propellers to replace critical material, will be made available after the war for many other uses. This material has been built up from sheets of wood uniformly impregnated with thermosetting phenolic resin, laminated under heat and pressure to composite structure. The resin serves as a binder to increase the splitting resistance as well as providing water resistance. Compression of the wood provides approximately one-half the original thickness and weight twice as heavy as the raw wood.

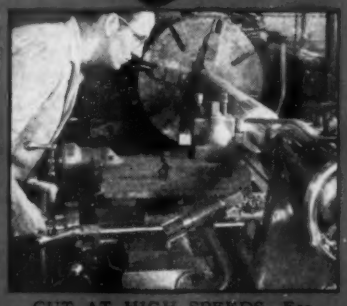
Physical properties of Pregwood include vibration absorption, shock resistance, shear and elastic modulus, tensile strength and resistance to creep or deformation. The laminations in this material can be built up with the grain going all in one direction, or with some laminations proceeding in a cross direction.

Bakelite Molding Material Has High Impact Resistance

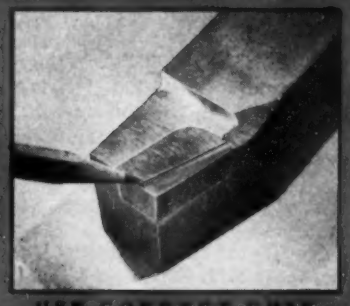
BM-16468, a high impact-resistant molding material, is being produced by Bakelite Corp., 30 East 42 St., New York, N. Y. It is a black phenolic plastic having a stringer filler.

The physical properties of this molding plastic as indicated by tests are as follows: Compression strength, lb. per sq. in.—stress parallel to string filler 27,500 to 32,700, transverse 15,600 to 18,200; Tensile strength, lb. per sq. in.—transverse 7,500 to 8,500; Flexural strength, lb. per sq. in.—parallel 12,000 to 12,900, transverse 10,200 to 14,200; Maximum deflection, inches—parallel 0.086 to 0.122, transverse 0.095 to 0.118; Impact strength, Izod energy to break, ft.-lb. per in. of notch—parallel 3.49 to 4.84.

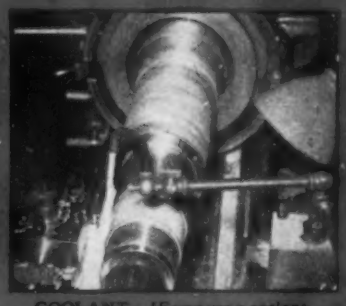
6 STEPS TOWARD TOP PERFORMANCE, WITH CARBIDES, WHEN YOU *CUT STEEL*



CUT AT HIGH SPEEDS—For top performance on the average steel-cutting job, don't cut at speeds less than 200 feet per minute. Slow speeds often cause failure.



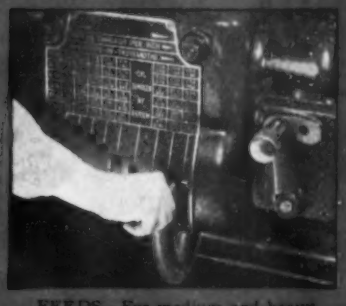
USE CORRECT CHIP BREAKER—When you break chips, break them right. Fit breaker to the job. The ground-in step-type shown is usually best.



COOLANT—If you use a coolant, provide a heavy, continuous stream, preferably under pressure. If you can't provide ample coolant, it is better to cut dry.

KEEP TOOLS SHARP—Avoid running tools until excessively dull. This causes breakage or drastically shortened tool life. Grind tools at regular intervals for best results.

PROVIDE RIGID SET-UP—Keep tools at absolute minimum overhang necessary to clear work. Chuck part firmly. Rigidity is important with carbides.



FEEDS—For medium and heavy cuts on steel, use feed not less than .010" per revolution, and preferably .015" to .025". Light feeds "rub" tool, causing rapid dulling.

● Important in getting top performance, when cutting steel with carbides, are the six steps shown above. When correctly applied, carbide tools produce results far surpassing the performance of ordinary tools. They operate at machine speeds as high as 4 to 5 times faster than ordinary tools, stay sharp up to 10 times longer, and increase output often as much as 300%.

Important, too, is the carbide you use. When you select from the complete line of carbides produced by Carboloy Company, you get the best type for your particular job—whether it be the popularly designated "titanium carbides", "tantalum carbides", "tungsten carbides"—or "tri-carbide" grades.

Send for catalog GT-142 listing specifications and prices of more than 300 standard Carboloy Cemented Carbide tools and blanks for machining all types of metals and non-metallics.

CARBOLOY COMPANY, INC., DETROIT 32, MICHIGAN

Birmingham • Chicago • Cleveland • Los Angeles • Newark • Philadelphia • Pittsburgh • Seattle

CANADIAN REPRESENTATIVE: Canadian General Electric Co., Ltd., Toronto, Ont.
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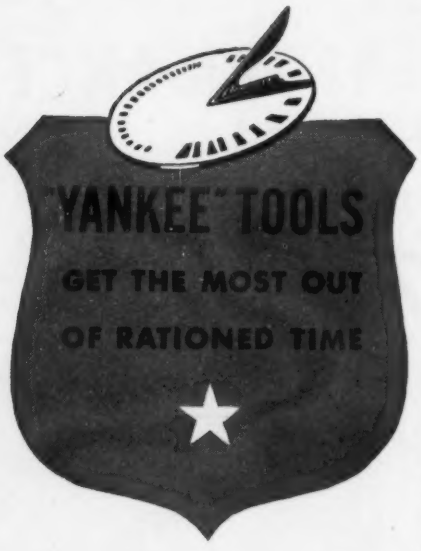
63% OF ALL **CARBOLOY** TRADEMARK CEMENTED CARBIDES PRODUCED TODAY FOR MACHINING PURPOSES IS USED FOR **CUTTING STEEL**

Are you using Carboloy Training Films? Six films available on Design, Application, Use of Chip Breakers and Maintenance. Send for Booklet GT-151.

CARBOLOY TRADEMARK

TITANIUM — TANTALUM
TUNGSTEN — CARBIDES

FOR HEAVY ROUGHING • HIGH SPEED FINISHING • INTERRUPTED CUTTING • ON ALL STEELS



A half-century before death rained from the skies over Pearl Harbor, "Yankee" Tools were putting *extra* minutes, *saved* seconds, into the hands of skilled mechanics everywhere. Now, when time is of the essence, "Yankee" Tools continue to speed production, to salvage that remnant of time left to America in which to deliver the knock-out blow.

The war we didn't want will be behind us one day, and "Yankee" Fine Mechanics' Tools will have had a part in putting it there. In the meantime, give America, and all America means to you, your best. And, when you re-order "Yankee" Tools, be sure to provide priority ratings whenever possible. Order through your supply house or write to us . . . c/o Dept. AM8.

"YANKEE" VISES
Four Handy Sizes with Swivel Base.
V-block holds round stock securely.

"YANKEE" TOOLS
make good mechanics better
North Bros. Mfg. Co., Phila., U. S. A.
Extended Tools

TRADE PUBLICATIONS

CONTROL Askania Regulator Co., Chicago, Ill., has published Bulletin No. 118, describing and illustrating the hydraulic jet-pipe principle of automatic control.

CONTROL Bulletin A-112, issued by the Bristol Co., Waterbury, Conn., highlights refinements of free-vane convertible type air-operated controllers.

CUTTING OILS A booklet discussing properties and uses of "Dresinates," water soluble resinates, in soluble oils has just been issued by the Paper Makers Chemical Dept., Hercules Powder Co., Wilmington, Del.

DIE STEEL "HWD" hot work die steel and its application and advantages are discussed in catalog sheets (form SL-2014) issued by Firth-Sterling Steel Co., McKeesport, Pa.

DRILLING Circular No. 743, published by Morey Machinery Co., 410 Broome St., New York 13, N. Y., describes that firm's deep hole drilling machines, made in the duplex and single speed models, equipped both for hydraulic feed or mechanical feed.

DRIVE BELTS A catalog issued by Manheim Mfg. & Belting Co., Manheim, Pa., describes, pictures and prices "Veelos V-Belt."

ELECTRIC BRAKE Empire Electric Brake Co., South 14 St., Newark, N. J., offers a bulletin giving dimensional drawings for and torque delivered by each of three stock sizes of the Magdraulic electric brake.

ELECTRIC SWITCHES A loose-leaf, file-size catalog showing its complete line of snap action midget switches may be had from Acro Electric Co., 1305 Superior Ave., Cleveland, Ohio.

GRINDING Bulletin No. 502, has been issued by Hammond-Machinery Builders, Inc., 1618 Douglas Ave., Kalamazoo 54 F, Mich., illustrating that manufacturer's cylindrical grinding, polishing and buffing machines. It gives detailed information for finishing of ¼ to 9 in. outside diameter tubes, rubs, bars and a wide variety of cylindrical shapes.

HEAT CONTROL The Brown Instrument Co., Wayne & Robert Aves., Philadelphia 44, Pa., has issued bulletin HT-S-2, "Brown Pyrometer Control of High Speed Salt Baths." Sections of the bulletin are devoted to the use of salt baths, heating principles and control problems encountered in this application. Included are descriptions of the installation and operation of the control system.

INCOME TAX DATA Thomas & Skinner Steel Products Co., 110 East 23 St., Indianapolis 5, Ind., has prepared a file-size card presenting a simplified schedule "for determining the pay-as-you-go tax deduction from each employee's weekly pay."

LIGHTS Dimension and application data for Swivelier Worklites are given in catalog No. 102, published by Reliance Devices Co., 510 Sixth Ave., New York, N. Y.

MANGANESE STEEL Bulletin No. 543-G of the American Manganese Steel Div., American Brake Shoe Co., Chicago Heights, Ill., relates how manganese steel is helping industry generally to "carry on" effectively in war production.

METAL FINISHING Preparing galvanized iron and other zinc or cadmium surfaces to assure adherence of paint is described in a file-size technical service data sheet, No. 7-2-5, available from American Chemical Paint Co., Ambler, Pa.

MOLDING Resinous Products & Chemical Co., Washington Square, Philadelphia, Pa., has published a brochure discussing flexible bag molding of curved plywood.

MOTORS Century Electric Co., 1806 Pine St., St. Louis, Mo., has published bulletin 344A, telling how to select the squirrel-cage induction polyphase motor best suited for an application.

PLATING AND POLISH EQUIPMENT Machines and related equipment for plating and polishing operations are described in catalog No. 5 available from the Chas. F. L'Hommedieu & Sons Co., 4521 Ogden Ave., Chicago, Ill.

POWER UNIT Hydraulic Machine, Inc., 13825 Ford Rd., Dearborn, Mich., has prepared a catalog of its ten different models of hydraulic power units, showing what can be done in conjunction with new machines or for changeover of existing equipment to hydraulics.

PRINTS A machine for making photographic copies up to 18×24 in. is described in a folder available from the American Photocopy Equipment Co., 2849 N. Clark St., Chicago, Ill.

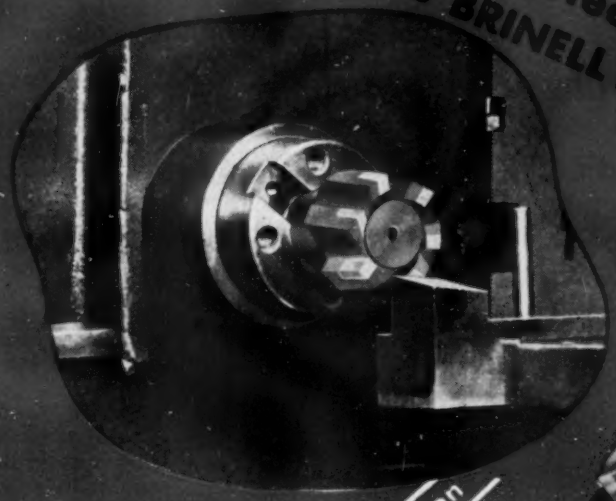
RECTIFIERS McColpin-Christie Corp., 4920 S. Figueroa St., Los Angeles, Calif., has available catalog sheets Nos. 300 and 301, describing the advantages of over 50 new models of industrial electrical rectifiers.

REPRODUCTION A 40-page handbook available from Paragon-Revolute Corp., 77 South Ave., Rochester, N. Y., describes the various processes and equipment for making blueprints, direct-process prints, sepia prints and reproduced tracings.

* THIRD IN A SERIES *

To Mill Steel efficiently up to 550 BRINELL HARDNESS

The Problem



The Solution

Kennamilling

KENNAMILLING HAS BECOME INCREASINGLY POPULAR BECAUSE:

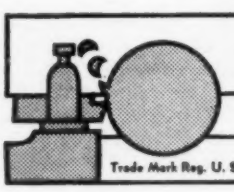
1. Face milling can be done at startling speeds.
2. KENNAMILLING permits greater table feeds and greater loads per tooth.
3. KENNAMILLING permits the use of double negative rake angles to produce a very rugged milling cutter.
4. KENNAMETAL'S non-galling properties, hardness, and rupture strength permit milling of High Brinell steels.
5. KENNAMILLING produces precision finishes and is not limited to light cuts.

Armor plate brackets were being milled with high speed steel; only 30 were completed before the high speed steel cutter became dull. A six-bladed home made cutter with 22½° and 67° side cutting edge angle was made, with KENNAMETAL Style 12T50 tools.

The 6-blade, 6" diameter cutter was run at 80 rpm, 8" table feed per minute, .016" feed per tool, and depth of cut 7/16". 176 brackets were milled through KENNAMILLING before the blades needed resharpening.

KENNAMILLING, sometimes referred to as Hyper-milling or Super-milling, since April 1940 has enabled plants to obtain the greatest possible steel-cutting production on face-milling operations. The strength and hardness of KENNAMETAL steel-cutting carbides now have been combined with the rugged Meehanite bodies of GRAYSON milling cutters to form the GRAYSON-KENNAMETAL shock-resistant milling cutter, designed for maximum production on milling operations on all metals.

Write for complete information about KENNAMILLING, the pioneer process of face-milling steels with cemented carbides. KENNAMETAL engineers will assist you in selecting the proper type GRAYSON-KENNAMETAL milling cutter for your particular milling problem.



KENNAMETAL Inc.

103 Lloyd Ave., Latrobe, Pa.

Trade Mark Reg. U. S. Pat. Off.

Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York (Exclusive of Canada and Great Britain)

KENNAMETAL THE All America CARBIDE

THIS IS THE WHEEL* MR. JONES

• Maybe you were stumped by grinding jobs before, but they won't worry you any more.

300 shapes and sizes—every grade and grain—there is a Chicago Mounted Wheel custom-built to take on *any* grinding problem. Each wheel is a whirling point of power that turns your jobs out smooth—and in a hurry.

PROMPT DELIVERY

Action is the keynote from the moment your order comes in. Our wartime set-up concentrates on mounted points and grinding wheels 3" in diameter and under. Production is stepped up and keeps pace with demand. Another advantage to you is our central location.

*Half a century of specialization has established our reputation as *the* small wheel people of the abrasive industry.

TEST WHEEL FREE — Tell us the job, type grinder and size wheel you use and we'll send one prepaid.

NEW CATALOG — Shows Chicago Mounted Wheels in actual colors, also portable electric tools and time-saving accessories.

CHICAGO WHEEL & MFG. COMPANY

1101 W. Monroe St., Dept. AT — Chicago, Illinois

☐ Send Mounted Wheel Catalog AT

☐ Free Wheel Size..... Name .....

☐ Also interested in .....

RIVETS The Rivnut, an internally threaded and counterbored tubular rivet that can be headed blind is described in manual 2-8970-G, issued by and available from B. F. Goodrich Co., Akron, Ohio.

RIVETING Tinnerman Products, Inc., 2113 Fulton Road, Cleveland, Ohio, has prepared a 20-page illustrated aircraft summary catalog showing 50 new "Speed Nut" and "Speed Clip" applications designed to cut assembly time and save weight. How the Speed Nut System performs multiple functions by combining two or more parts into one is explained.

SHEAVES Worthing Pump & Machinery Corp., Harrison, N. J., has published Bulletin V-1400-B7C describing features of "Quick-Detachable" sheaves, and giving detailed dimensions and application data.

SLOTTER The new edition of a 4-page catalog, describing the Universal Slotmaster and illustrating some of the ways it may be used to save tools and set-ups, has been released by Experimental Tool and Die Co., 12605 Greiner, Detroit, Mich.

STAINLESS STEEL Types "A" and "B" "Hard" stainless steels are discussed and a table of physical properties and working data presented in catalog sheets, Form SL-2009. Types "T" and "FC" are similarly treated in Form SL-2010. Each has been issued by Firth-Sterling Steel Co., McKeesport, Pa.

STEELS Catalog sheets (Form SL-2011) issued by Firth-Sterling Steel Co., McKeesport, Pa., describes and gives specifications and uses of Sterling "18-8" Steels.

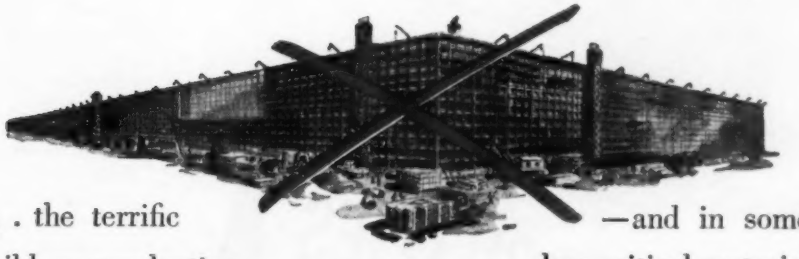
STEELS "Steel-Sight Manual," published by Western Supply Co., 441 Vine St., Cincinnati 2, Ohio, describes precision tool steels available from that firm.

THERMOCOUPLES Arglay S. Richards Co., Winchester St., Newton Highlands, Mass., has published catalog No. 3, describing parts, assemblies and accessories of standard industrial thermocouples for all makes of pyrometers.

TUBE FITTINGS A special instruction folder detailing installation procedures for "Ermeto" safety tube and pipe fittings has been issued by the manufacturer of this line, The Weatherhead Co., 300 E. 131 St., Cleveland, Ohio.

TUBING Summerill Tubing Co., Bridgeport, Pa., offers a 22-page booklet which includes specifications of aircraft tubing, of seamless, welded and stainless variety. New data on machine allowances and a heat-treating chart for NE-8630 steel are added.

PART of the War IS OVER



Part of the war . . . the terrific battle to quickly build up production capacity of war materials . . . is over. The productive capacity of many new plants has far exceeded early estimates . . . as a result the inefficient producers will be curtailed and competitive conditions will return.

And competition means that frozen designs must be thawed—developments for the future must be brought nearer the production stage. Builders must be able to offer better machines —and in some cases must use less critical materials.

Vickers Hydromotive Controls provide a most important design resource for improvement of machines in the important fields of better control—higher production rates—wider utility—greater safety and the elimination of operational difficulties.

You will find it advantageous to have a Vickers Application Engineer discuss with you the possibilities of improved machine controls.

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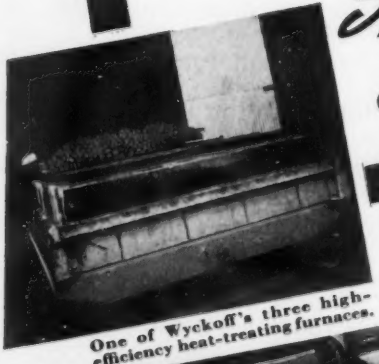
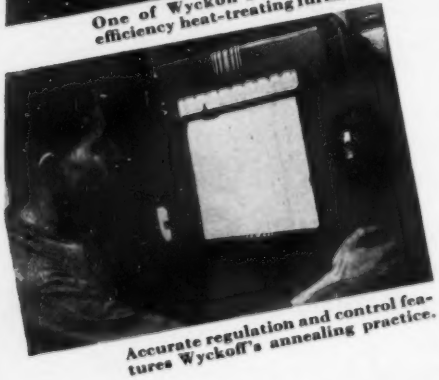
FURNACE FACILITIES *Second to None* IN THE COLD DRAWN INDUSTRY



One of Wyckoff's three high-efficiency heat-treating furnaces.



Accurate regulation and control features Wyckoff's annealing practice.

The unexcelled Wyckoff heat-treating equipment that today serves Uncle Sam's needs 100%, will be ready and "fit as a fiddle" to serve *you* after the war.

Then, when you need to retain the specific *physical properties* and machinability ratios of cold drawn steel you can safely entrust the job to Wyckoff. The Reason? Wyckoff annealing, quenching and tempering facilities are designed *especially* to furnish these characteristics in cold drawn steels.

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First National Bank Bldg., Pittsburgh, Pa.
3200 So. Kedzie Avenue, Chicago, Ill.

Mills at Ambridge, Pa. and Chicago, Ill. . . Warehouse Stocks in Principal Cities

Manufacturers of Carbon and Alloy Steels . . . Leaded Steels . . . Turned and Polished Shafting . . . Turned and Ground Shafting . . . Wide Flats up to 12" x 2".

TUBING Catalog No. 113 of the Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J., describes the types of metal tubing made by the company for carrying gases and liquids, gives data on fittings and charts covering pressure, radius of bend and other essential information.

VALVES R-S Products Corp., Wayne Junction, Philadelphia, Pa., is offering Bulletin No. 16-B, which contains dimension tables for manually or automatically controlled butterfly valves ranging from 15 to 125 lb. per sq. in. for regulating gases of liquids.

VIBRATING EQUIPMENT Jeffrey Manufacturing Co., Columbus, Ohio, offers catalog No. 750, which describes and illustrates components of electric vibrating units.

WELDING The three essentials of proper welding procedure—correct electrode, correct travel speed and correct welding current—are discussed in the two welding check charts, each 18×25 in., announced by The Hobart Brothers Co., Troy, Ohio, 10 cents for both.

WELDING ALLOYS Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y., has prepared a chart presenting the physical properties and procedure information for low-temperature welding alloys.

WOOD How wood can help solve design and production problems on war equipment is the subject of a 32-page booklet available from Kay Displays, Inc., 9 East 40 St., New York, N. Y.

NEW BOOKS

WORLD MINERALS AND WORLD PEACE—*By Dr. C. K. Leith, geologist, University of Wisconsin, J. W. Furness, formerly chief of the Economics and Statistics Branch, Bureau of Mines, and Dr. Cleona Lewis, author of several of the Brookings Institution's volumes in the field of international economic relations. 253 pages. Published by The Brookings Institution, Washington, D.C.* $2.50.

The control of the production and trade in minerals is offered as an effective method of preventing future wars. This theory rests on the hypothesis that industrialism is largely based on mineral resources, thereby making the control of essential mineral supplies a subject of international rivalry and controversy, and an essential part of any program for the prevention of future wars.

The study shows how the rise in mineral production and consumption has paralleled the expansion of industry in the North Atlantic power belt, and how, both in volume and variety, the mineral requirements of industry have

been increased with the progress of our machine age.

Practically all countries participate in furnishing the world's annual supply of minerals. Some areas are well endowed with certain of these important raw materials, some with others. All countries are deficient in some one or more minerals and must obtain them through trade. The Axis powers, cut off from trade with many areas, are seriously deficient in many strategic minerals. Even the United Nations are short of some.

Various kinds of economic and political controls have tended to restrict the movement of minerals from the best and cheapest sources of supply. For the most part, governments have adopted such measures with a two-fold aim in view: the strengthening of the military power of their countries; and the improvement of the economic position of their peoples.

The Atlantic Charter has raised sharply the question of equality of access to the world's raw materials of all kinds. By implication, such equality of access is denied to aggresor nations seeking to build up their land, sea, and air armaments. The practical question is whether controls on the production and trade in minerals can be so devised and administered as to future wars.

SEEN and HEARD

By JOHN R. GODFREY

Castings in Place of Forgings

Among the developments as a result of the war is the use of centrifugal steel castings to replace forgings. Of course centrifugal castings are not new. The General Electric Company made a number of large bearings in this way many years ago.

The latest war development is steel castings for airplane cylinder barrels where forgings were used previously. This practice has been developed by Ford and has been approved by military authorities after severe tests. In some tests the castings show qualities superior to forgings.

There seems to be no reason why castings of this kind cannot be used in machine tool applications. Hollow lathe spindles and quills for various machines offer opportunity for consideration and trial.

Women in *This* War

Women in industry began in the textile mills. First with the native village girls, followed by women from other lands, across the sea and from north of the border. Office workers came next but even here they had an uphill fight and were nearly always paid at a lower rate than men. Watch and clock making shops, small arms makers and business machine builders have also used

. . . All Types—Classes
—Sizes of Industry Are Well
Served by STANDARD CONVEYORS

In aviation machine shops—munitions plants—steel mills—foundries—producers of metals and alloys—in chemical and food plants—practically every classification of industry—A to Z—Standard power and gravity Conveyors are at work. Their dependable, trouble-free performance is an important aid to maintaining the fast pace of wartime production.

Standard Conveyors have been known and used by industry for more than 35 years. The highly diversified experience of Standard Conveyor engineers is at your service for immediate or future needs.

A valuable reference book, "Conveyors by Standard" Catalog AM-8 will be sent in response to your request.

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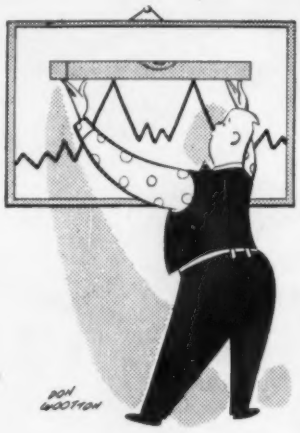

IS THIS ON THE LEVEL?

By leveling off the peaks and valleys of production, industry can fulfill one of its greatest social obligations to this country—and to the men now in the service.

By providing steady, year-round employment for its workers, industry will also gain all the advantages of a stable, efficient labor force—loyal workers, low costs and high-quality products.

Will not 500 workers continuously employed throughout the year provide more buying power and better community stability than 1500 itinerant workers employed only 3 or 4 months during the year?

That is the question we will have to answer. It can and must be answered affirmatively.

There are many tools of management engineering which must be applied to this important leveling off operation. And it's none too early NOW to start plans aimed at making continuous Postwar Jobs. Our organization has been working for some time on such plans for a number of clients. Can we be of help to you?

Geo. D. Trundle Jr.
President

THE TRUNDLE ENGINEERING COMPANY

Consulting Management Engineering

GENERAL OFFICES · CLEVELAND · BULKLEY BLDG.
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women in large numbers. The last war gave a new impetus to their employment in the shop, but usually at a lower rate than men.

This inequality has been largely eliminated in the present war plants. And if one has any doubts as to the efficiency of women workers, they have only to visit some of the better known plants building airplanes. They run all sorts of machines except the heaviest presses. They predominate in hydropress work, in welding and in riveting. One fuselage assembly line in a basic trainer plant hasn't a man in it. In other plants, their work varies from "move man" to inspectors and engineers. And they are doing a good job. I've only found one plant where management was not enthusiastic about their work and I'm guessing the fault does not lie with the women workers.

Men Who Didn't Wait

Every good mechanic likes to see and to have the best machine tools available. But if all of them had waited for new machines to be built, our war efforts would have been sadly delayed. I am thinking particularly of two small shops on the West Coast in which ingenuity and determination have done much to hasten production of parts that were badly needed. The parts vary from a comparatively small bronze nut to propeller shafts for Liberty ships.

The first shop utilized what standard machines it had by making fixtures. It also built a number of small special machines from old automobile rear ends. The other rebuilt some of its lathes, built makeshift turning machines and is turning out big propeller shafts as fast as needed.

Headstocks were made from steel plate by cutting and welding. Husky babbit bearings support the lathe spindle. Feed change gears came from the automobile junk yards. The work those makeshift machines are doing is highly creditable in every way. The men in both shops would like to have better machine equipment. I hope they get it after the war. But they didn't wait for it as did some I know.

How Far Can We Use Negative Rake?

Those of us who have felt that proper top rake was necessary in all cutting tools have had our ideas shaken by the success of negative rake lathe tools and milling cutters, especially on interrupted cuts and tough materials, such as armor plate. We have also had to revise our ideas as to the kind of finish left by these tools. Apparently top rake does not really *cut* but *tears* the metal away from the work. While it seems as though negative rake would literally *push* the metal away from the work, this action seems to produce a smoother surface by closing the pores instead of tending to open them.

Carrying the idea still further brings up the question of using negative rake cutting edges on such tools as drills and reamers. With the twist drill the helical flutes serve two purposes. They make it easy to maintain a positive rake on the cutting edge and also help in chip removal, on the screw conveyor principle. Flat drills could be ground with either positive or negative rake edges, but lack the aid of the helix in removing chips. On reamers the negative rake has even less appeal when we consider its tendency to expand the hole rather than to remove metal. It is hard enough to keep reamed holes to size with a positive rake. It would seem as though the negative rake would make it impossible, especially where the amount of metal around the hole was limited.

Use Surplus Tools for Rehabilitation—Send Postwar Surplus Abroad

BY LEO MALCHIN

Government-owned machine tools should not be returned to the original manufacturers for reconditioning and sale, for this will tend to clog the production channels for 20 years, allowing tool-producing equipment to deteriorate and become obsolete. If, as has been suggested, the government retain ownership of the tools until the original manufacturer shall have a market for them, then the government will control the industry. The plan is subsidy under another guise.

But if the government would utilize these machines to reinstate in business those soldiers who closed their shops to be mobilized, retaining ownership and preventing resale for five years, they would be recreating a segment of our production economy.

Similarly, surplus machine tools should be offered for sale to those small machine shops which paid ridiculous prices for 40-year old "rebuilt and guaranteed" junk, that they might do defense work. The cost of the old machines which were not amortized from war profits should be taken into consideration in making this transfer. The old tools should be destroyed, and the newly purchased tools "frozen" for five years or so.

The remainder of the government-owned tools should be sold to foreign countries for rehabilitation, at low prices and on the installment plan if necessary. This should be done under a requirement that these tools may not be reimported. The American tool industry will benefit from this move through the extensive introduction of its products to foreign shops, the demand for accessories and parts and later the demand for replacements. Each machine from the United States, sold in Europe or China will cut possible sale for German future production.

Strictly a Thoroughbred
● Three generations behind each and every Dearborn Gage Company Standard. In the "drive to the wire" breeding tells; that is why today at the finish line in the plants of the precision manufacturers throughout the country you find chromium plated gage blocks by Dearborn.
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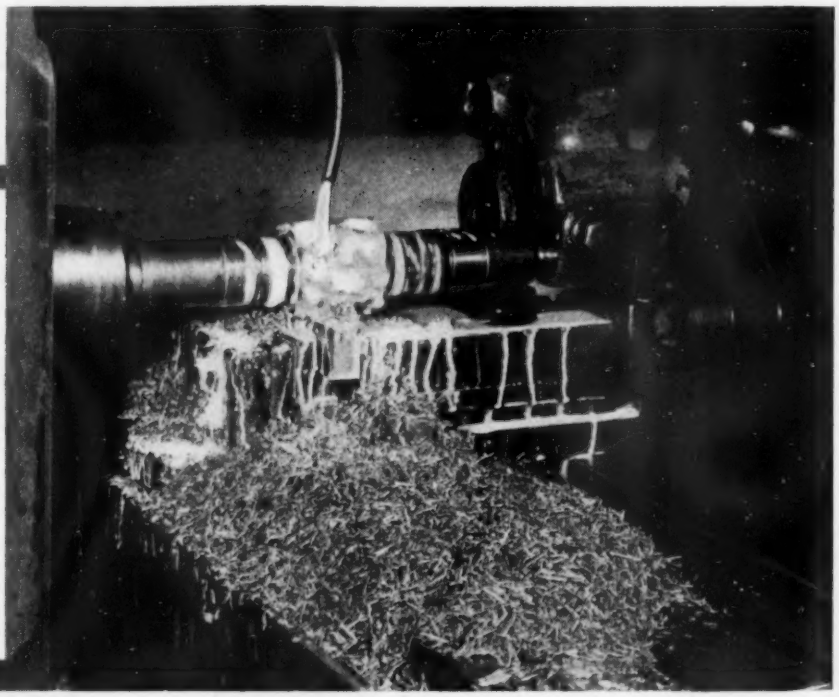
W —OR "WORKING SETS"
"W" accuracy is a guaranteed tolerance of ± .000008 inch per inch or fraction thereof, of gage.
I —OR "INSPECTION SETS"
"I" accuracy is a guaranteed tolerance of ± .000004 inch per inch or fraction thereof, of gage.
L —OR "LABORATORY SETS"
"L" accuracy is a guaranteed tolerance of ± .000002 inch per inch or fraction thereof, of gage.

Official U. S. Navy Photograph

OVERSEAS ATTACK demands top national production. For maintenance of wartime schedules in *MACHINING* use . . .

. . . SINCLAIR CUTTING OILS and COOLANTS. These oils promote higher speeds, closer tolerances, finer finish, and longer tool life. They are suited to all types of metal cutting operations.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.



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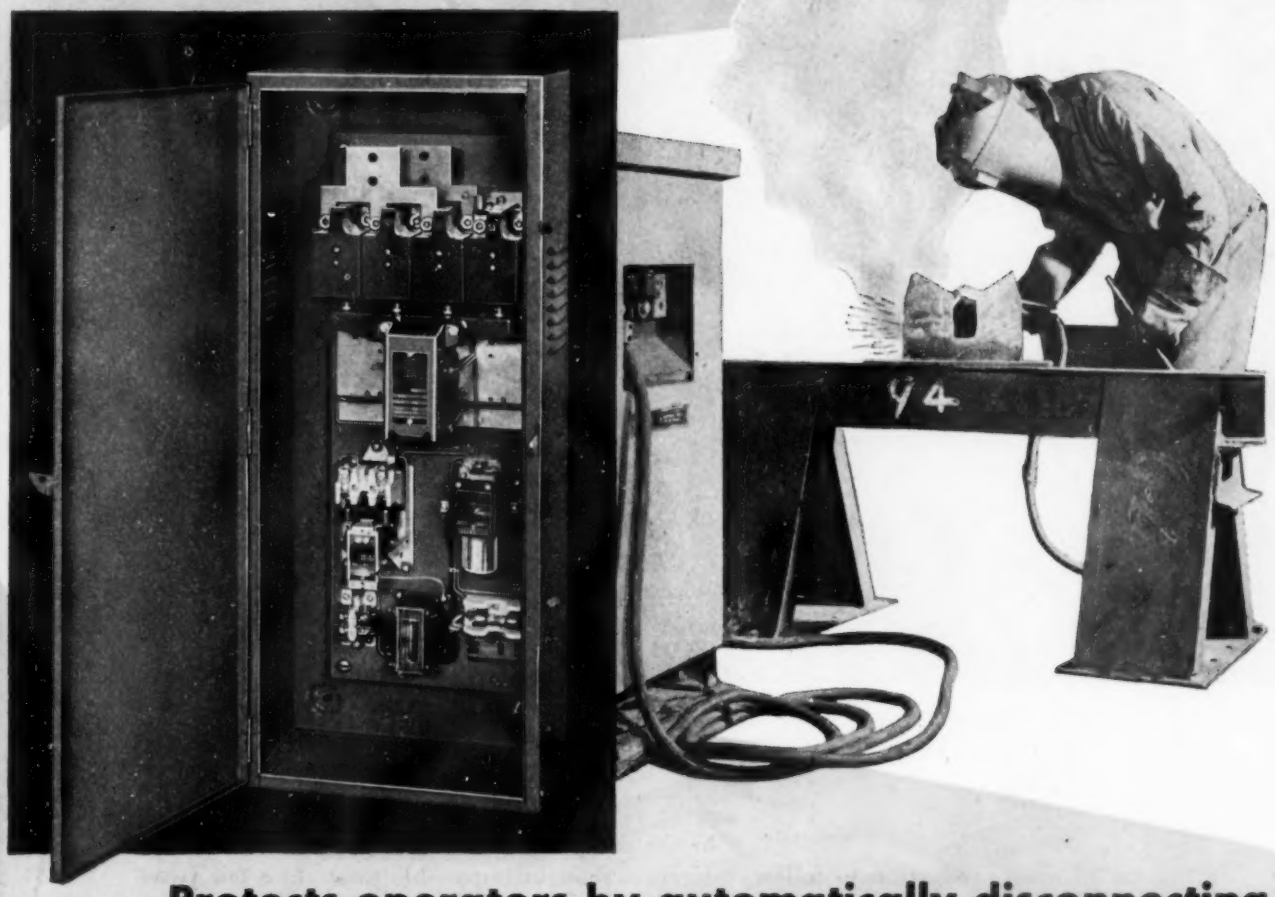
SQUARE D *Announces*
SAFETY CONTROL FOR A·C· ARC WELDERS



Protects operators by automatically disconnecting welding transformer when arc is broken . . . .

HIGH open circuit voltages of A. C. arc welders (transformer type) create a definite hazard to operators. Physical contact from electrode to grounded metal surfaces (when not welding) is sometimes serious.

Square D's new class 8992 safety panels eliminate this hazard by automatically disconnecting the welder transformer after the arc is broken. The transformer is automatically reconnected the instant the operator touches the electrode to the work. Thus, the arc is struck with no delay. There is no loss in operating speed or efficiency.

There is an economy angle, too. When Square D safety panels are used, the welding transformer primary circuit is connected to the power line only while the arc is held. Substantial saving in power is effected when a number of welders are used on a single power system and the power factor is improved.

These new safety panels can be used with any make or model of A. C. transformer type arc welder. External connections are simple and internal connections of the welder need not be disturbed.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

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Tolerance ±.0001"

with the MOORE JIG BORER

The deadly accuracy of our most powerful weapons starts with accuracy in the machining of their smallest parts. Ten Moore Jig Borers operated by women at the Arma Corporation speed the production of high-precision instruments for the United States Navy.

☆ ☆ ☆ ☆ For the complex equipment of war—and the amazing age of mass production to follow—tolerances thought impossible to attain a few years ago are today routine requirements. The Moore Precision Jig Borer answers the increasing demands for greater accuracy and speed in boring holes for jigs, fixtures, dies, gauges and special machine parts—and yet is so simple to operate that women quickly become proficient at it. ¶ Moore-produced micrometer screws, ground to an accuracy never achieved before, give the Coordinate Location Method—an outstanding feature of the Moore Jig Borer—definite advantages over the graduated scale and size block methods of measurement. Inaccuracies between any two points, with the long screw, will not exceed .0002" and with the short screw .0001". The Moore Jig Borer is guaranteed to space and bore holes accurately within limits of .00025" in any position of the table. ¶ The range, sensitivity and rigidity of the spindle are evidenced in its ability to drill holes of 1/32" or less and yet to take a one-quarter inch cut accurately in increasing a hole from 2" to 2½" in one cut under power feed.

PARTNERS IN PRODUCTION—The Moore Jig Borer and the Moore Jig Grinder, each outstanding in its own specialty, together form a modern toolroom partnership to save production time and increase die life. The Jig Grinder finish-grinds holes to size and location on both hard and soft work within .0001". Write today for descriptive literature on how these two machines will modernize your toolroom production.

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MOORE TOOLS

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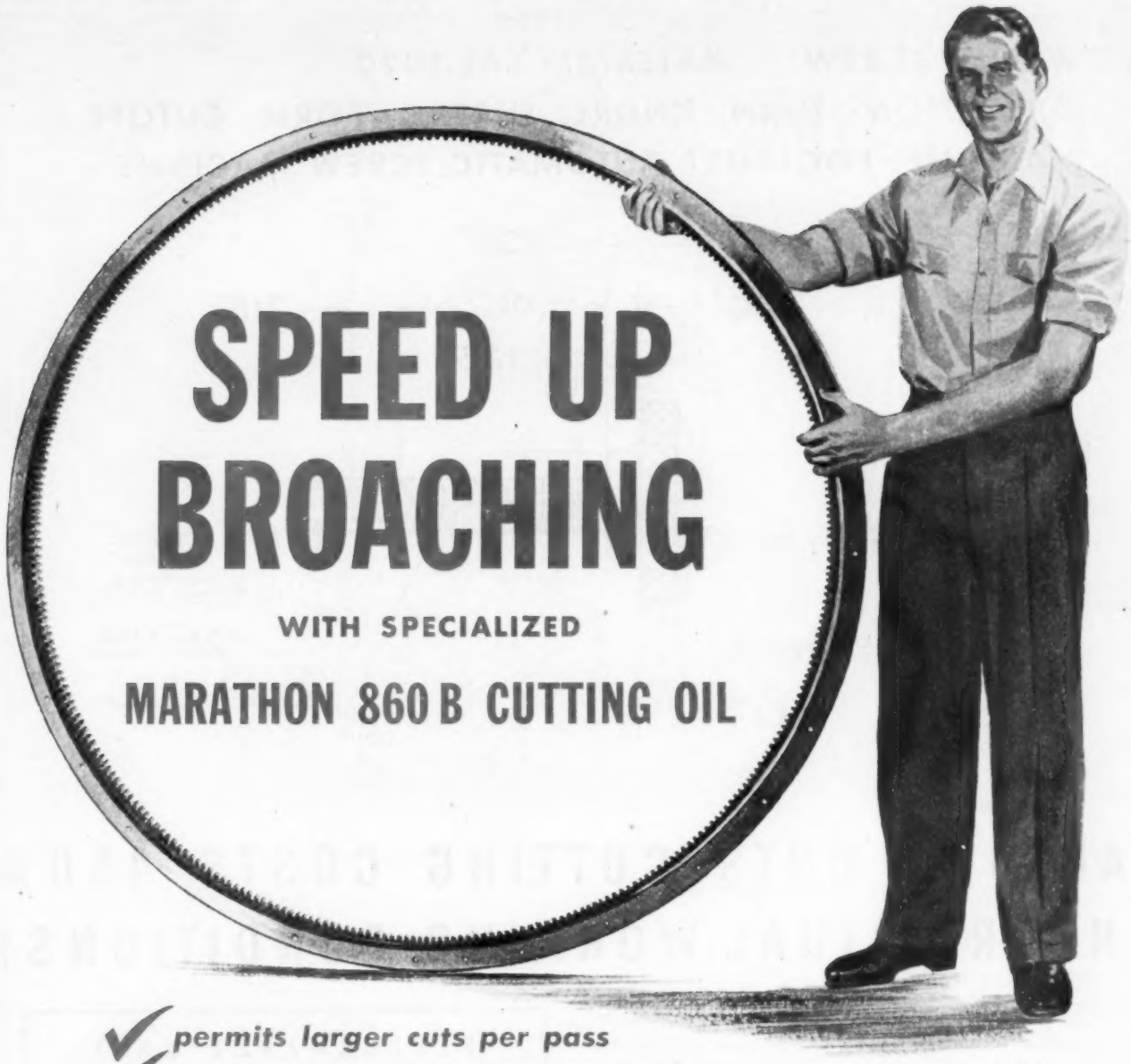

SPEED UP BROACHING

WITH SPECIALIZED

MARATHON 860 B CUTTING OIL

- ✓ *permits larger cuts per pass*
- ✓ *holds temperature down to minimum — prolongs tool life*
- ✓ *eliminates smoke*
- ✓ *improves finish*

HERE IS A CUTTING OIL that permits faster cutting, even on the most difficult operations. In fact, manufacturers of airplane motors, tanks and guns have found Marathon 860 B *necessary* to maintain and increase production. For Marathon 860 B permits more stock to be removed per pass—and without undue increase in temperature. It improves the finish—and the low frictional characteristic of 860 B is helpful in broaching all types of steel. Marathon 860 B Cutting Oil is a working tool capable of being adjusted to fit both general and specific requirements. May be used straight or in easily blended dilutions depending on the operation.

Get the facts-

Phone, wire, write for an Ohio Oil lubrication engineer to call.

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A complete line of cutting and grinding oils for every metal working purpose.

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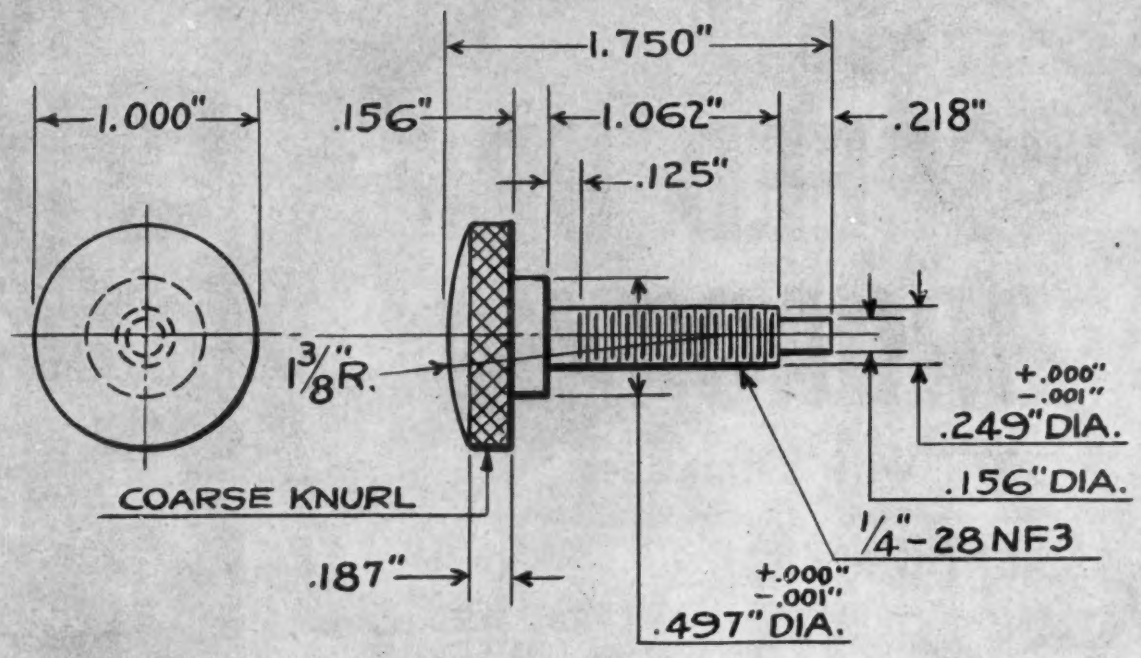
THE OHIO OIL CO.

GENERAL OFFICES: FINDLAY, OHIO

District Offices: Robinson, Ill., Indianapolis, Ind., Louisville, Ky.

PRODUCERS OF PETROLEUM SINCE 1887

WORK: SCREW **MATERIAL:** SAE 1020
OPERATION: TURN, KNURL, THREAD, FORM, CUTOFF
MACHINE: FOOTBURT AUTOMATIC SCREW MACHINE



TANTUNG CUTS CUTTING COSTS 450% UNDER ACTUAL WORKING CONDITIONS!

This record is not one that was made under ideal or test conditions. This **TANTUNG** performance datum was supplied from actual shop records of a leading war-plane plant.

TANTUNG actually cut the cost per piece 450%.

TANTUNG cut actual working time *by the same amazing ratio.*

If you are now using high-speed steel in any cutting operation, test **TANTUNG** and let *your* shop records prove the superiority of this new miracle cutting metal. **TANTUNG** sharpens easily and holds its cutting edge longer. Send today for complete information on this new cost-cutting tool.

PERFORMANCE DATA

TOOLING	ACTUAL TIME	PIECES PER HR.	COST PER 100 PIECES	SPEED SFM
HIGH-SPEED STEEL	4.30	13.9	$7.17	640
TANTUNG	.95	63.2	1.58	1060

REMARKS: The saving in time, money and increase in pieces per hour in this operation is tremendous. The superiority of **TANTUNG** over high-speed steel is clearly indicated.

CUSTOMER: A large war-plane manufacturer.

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What happens when tool meets work? The chips tell the story of performance. Cutting oils vitally affect finish and production.

A complete and valuable study of "MACHINING OF METALS"... including chip formation . . . is yours for the asking. Write for this book today.

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Get this NEW, FREE booklet on SURFACE PREPARATION OF your war products for BLACK OXIDE FINISHES

Describes how *THOROUGH*, FAST Oakite degreasing provides the *CHEMICALLY CLEAN* surfaces required for finishing ferrous and non-ferrous metals!

Upon the THOROUGHNESS with which metal surfaces are degreased depends, to a considerable degree, the SUCCESSFUL application of uniform, corrosion-resistant black oxide finishes.

That is why you will find this NEW, 16-page booklet extremely helpful in expediting this important work in your plant. It describes wartime Oakite cleaning developments and techniques that remove ALL smut, oil, grease and dirt FASTER, EASIER . . . that safely put iron, steel, aluminum, brass, zinc and copper surfaces in the CHEMICALLY CLEAN condition so essential for applying satisfactory black oxide coatings . . . and that keep production moving smoothly according to schedule!

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FOR EVERY CLEANING REQUIREMENT

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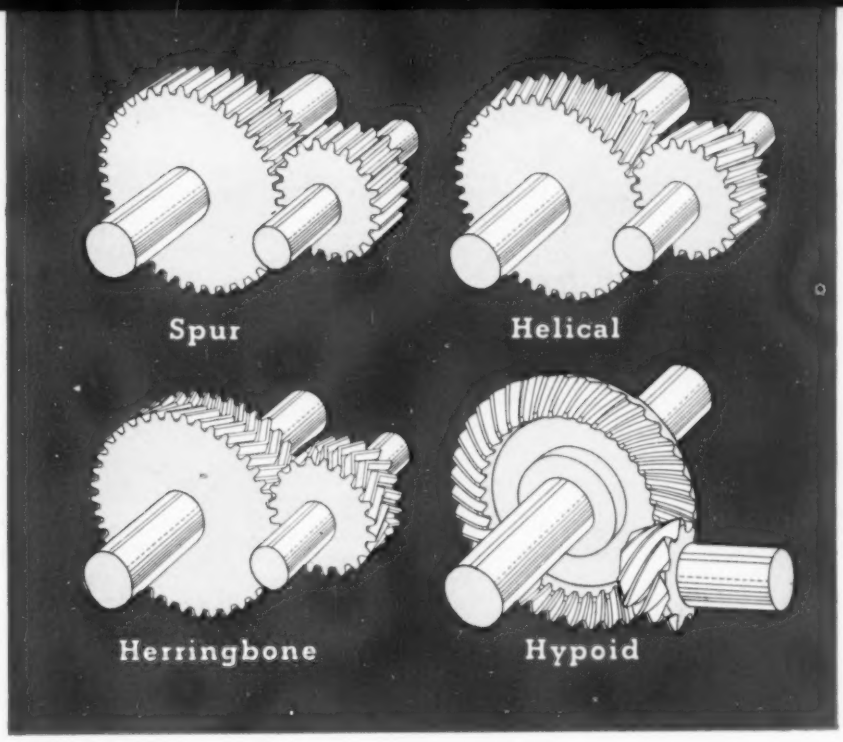


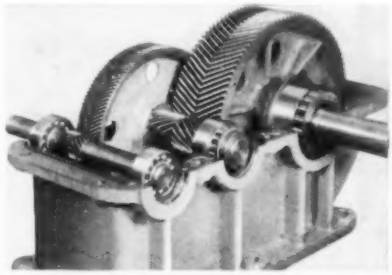
Help for hard-pressed teeth

• FOR HIGH external temperatures combined with heavy tooth loads, high load peaks or shocks, and also for exposed locations with extreme variation of external temperature, a leading gear manufacturer specifies the use of extreme pressure lubricants. This recommendation is in line with much of our experience.

These lubricants provide a load-carrying capacity many times that of straight mineral oils. They prevent scoring and galling of teeth when pressures are too great for protection by ordinary oil film. In the top flight of this type of product are Stanogear Leaded Lubricants. These lubricants have an endurance far beyond that of the usual E. P. lubricant, and therefore require changing much less frequently. Here are typical examples of the results they give:

Stanogear more than match for trouble-maker. Excessive wear and scuffing were troubling a midwest battery plant using a set of large, broad herringbone gears to drive a zinc rolling mill. Pressures were high, there was considerable shock load, gears ran very hot.

A number of makes of lubricants were tried without correcting the trouble. Then a Standard Lubrication Engineer was called in. He recommended Stanogear Leaded Lubricant No. 6X because it lubricates the teeth in spite of high pressures and results in lower gear temperatures. Also, it is highly stable and does not form the excessive deposits sometimes associated with the use of such products.



Herringbone speed reducer. This type of unit may be subjected to high external temperatures, combined with high peak or shock loads. Prevention of excessive wear may require use of high quality extreme pressure lubricants, such as Stanogear Leaded Lubricants.

To make doubly sure, the Engineer recommended spray application at the point of contact, resulting in further temperature reduction. These recommendations were adopted over a year ago, and the manufacturer has enjoyed trouble-free operation ever since.

Again Stanogear to the rescue. Here's another case of trouble going out when Stanogear Leaded Lubricant came in: A central west metal working plant was having excessive wear on a three-speed transmission driving a cut-off saw, and involving a chain of gears in an enclosed case. The oil level at the lower end of the case was only about three inches deep and there was a vertical lift of approximately 16 inches to the top gear. Several gear replacements had been required during an eight-months' period, using a conventional S.A.E. No. 90 automotive gear lubricant.

When a Standard Lubrication Engineer was called in, he recommended Stanogear Leaded Lubricant No. 3X. Its excellent load-carrying characteristic provided positive lubrication, with the result that there has been no evidence of excessive wear in about 18 months.

How to get help quickly. If you are having any trouble with power transmission equipment, let a Standard Engineer help you keep it doing its full wartime job. He has a complete line of lubricants which meet the many and varied requirements of this type of service. He also has had experience with ironing out difficulties with the same kind of equipment you use in your plant. For the Engineer nearest you, phone or write the nearest Standard Oil (Indiana) office, or 910 South Michigan Avenue, Chicago, Illinois. In Nebraska, address any Standard Oil Company of Nebraska office.

Oil is ammunition . . . Use it wisely

STANOGEAR
LEADED LUBRICANTS

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Cutting oil *News* letter

Practical suggestions from the field on how cutting oils and coolants are being used by midwest machine operators to lick tough wartime jobs.

AUGUST, 1943

Wisconsin shop, working beads on 20 mm. casings, lengthens tool life 80%

IN TURNING the beads on 20 mm. steel cartridge casings (1025 steel, 80 Rockwell hardness) using high speed moly tools, a Wisconsin shop found that the finish secured with soluble oil was not up to par and tool life was too short. Use of Thio Cutting Oil gave a swell finish, virtually eliminated rejects, increased tool life 80%.

How electrolysis was licked. In their efforts to keep going full tilt many shops bump into new and unexpected maintenance problems. A wire manufacturer in Indiana, for example, found that in using a high grade cup grease for bearing lubrication, some electrolytic action was encountered. This action was probably abetted by the small water content of that type of lubricant. A change to Stanodrip No. 229 solved this problem.

Can bolt threads be beautiful? Yes, say operators of an Illinois machine shop. Since they started using Acme Cutting Oil No. 110 on their bolt threading machines, the work is turned out faster, with better die life and a much cleaner thread finish.

Perhaps he has answers to your questions

Remember that a Standard cutting oil specialist has detailed information on many cutting problems, both from his own field experience and from data relayed to him by the Standard Oil Technical Department. He has, or can probably get, the answers to any cutting oil or coolant problem you are facing in your shop. For the name of the nearest Engineer, contact any Standard Oil Company (Indiana) office, or 910 S. Michigan Ave., Chicago, Ill. In Nebraska, address any Standard Oil Company of Nebraska office.

News of a cold nosing compound. We might as well tell you right off the bat this is no dog story. It's about a shop in Kansas City that was using ordinary cold nosing compound cut back with engine oil for work on 75 mm. projectiles. And it gave them these two operating headaches: 1. Difficulty in getting proper consistency; 2. Drawing ability wasn't what it should be. Now they use a Standard Oil lubricant especially adaptable for the service and "everything is jake," say the operators.

Batch filtering stops thread burning. A Ft. Wayne shop reports that batch filtering of thread grinding oil on Excello grinders every 4 or 5 days did away with bothersome smoking and burning of the threads in grinding a special type of stainless steel.

Suggestion for stopping tool chatter. It seems that a new "film" star has come to light. A Minneapolis shop found the answer to the tough problem of maintaining a film on ways and guides of machine tools with Stanolex No. 31. According to the report, this Stanolex film ended chatter and vibration of the carriage, and resulted in better finish on the work, even when under heavy loads using soluble oil as the cutting medium.

How stainless steel bushings were kept from turning blue. An automotive plant up in Michigan formerly used soluble oil for turning main and "con" rod bearings of truck engine crank shafts. Anxious to step up its production and better the tool life, this shop made some tests with Stanicut 107 BC. Applied in larger quantities than the soluble oil, the Stanicut cooled the work, and also made the tools last longer.... Then, the same oil was used successfully for turning, reaming and drilling thin-walled stainless steel bushings, which formerly tended to turn blue.

OIL IS AMMUNITION...USE IT WISELY

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

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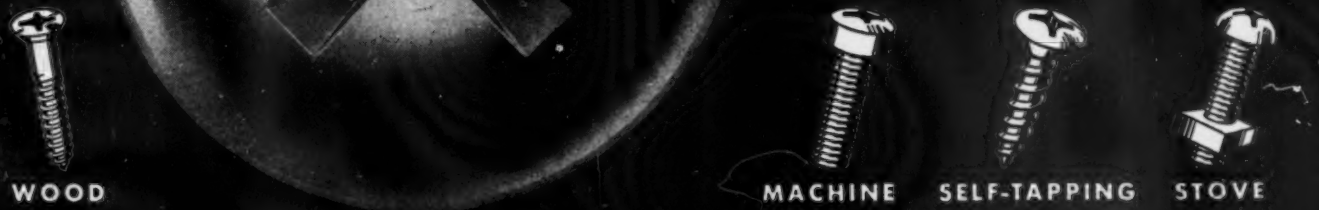
IT MUST BE RIGHT!

21 Leading Makers of Screws recommend the PHILLIPS RECESSED HEAD



21 Concerns Offer the Phillips Head

AMERICAN SCREW CO.	Providence, R. I.
THE BRISTOL CO.	Waterbury, Conn.
CENTRAL SCREW CO.	Chicago, Ill.
CHANDLER PRODUCTS CORP.	Cleveland, Ohio
CONTINENTAL SCREW CO.	New Bedford, Mass.
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INTERNATIONAL SCREW CO.	Detroit, Mich.
THE LAMSON & SESSIONS CO.	Cleveland, Ohio
THE NATIONAL SCREW & MFG. CO.	Cleveland, Ohio
NEW ENGLAND SCREW CO.	Keene, N. H.
THE CHARLES PARKER CO.	Meriden, Conn.
PARKER-KALON CORP.	New York, N. Y.
PAWTUCKET SCREW CO.	Pawtucket, R. I.
PHEOLL MANUFACTURING CO.	Chicago, Ill.
READING SCREW CO.	Norristown, Pa.
RUSSELL BURDSALL & WARD BOLT & NUT CO.	Port Chester, N. Y.
SCOVILL MANUFACTURING CO.	Waterville, Conn.
SHAKEPROOF INC.	Chicago, Ill.
THE SOUTHINGTON HARDWARE MFG. CO.	Southington, Conn.
WHITNEY SCREW CORP.	Nashua, N. H.

Out of the many screw heads designed through the years to eliminate screw driving troubles, *only* ONE has gained wide approval by the men who should know most about screws... the men who develop and produce fastening devices.

It is highly significant that the leaders in the screw industry . . . *21 concerns* . . . recommend the PHILLIPS RECESSED HEAD as the first recessed head that is *right* in every respect! It assures you that screw driving troubles will be ended when you specify PHILLIPS. Also, it means convenience in buying, and prompt and capable service.

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.

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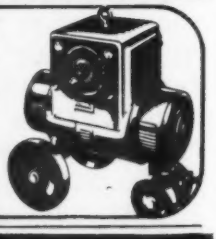

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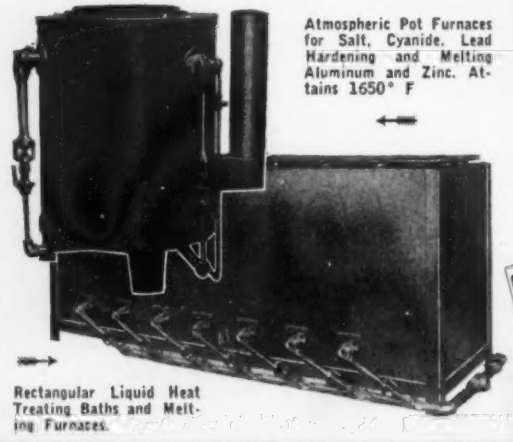

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More often than not, the ability to produce these alloy steels successfully to such close limits, and the added ability to multiply the tonnage many times under the necessities of war, come as a result of having developed the *original* technique. The accumulated knowledge and experience of the mill technicians and men who developed an idea into a special steel, and shouldered the trials of pioneering it commercially, make all the difference.

For Allegheny Ludlum, that is true in the cases of stainless steel, gasoline engine valve steel, and many alloys for electrical purposes. It is true also of certain tool and die steels, notably the DBL High Speed Steel analysis, which has replaced "18-4-1" on the majority of the nation's production jobs.

These steels of our development are among the most vital of the war. We want to place our "know-how" completely at your disposal, to help you select them wisely and use them well, without waste. ● Call on us for technical and fabricating data, or for the help of our Technical Staff.

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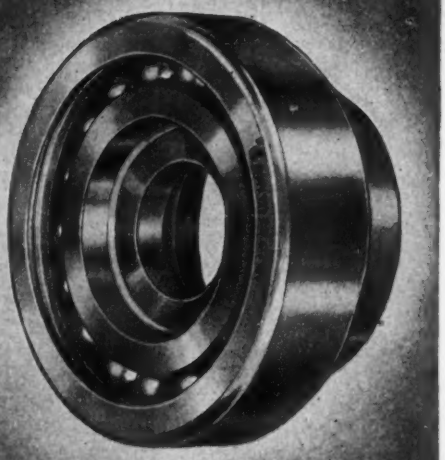

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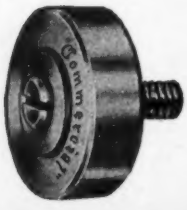

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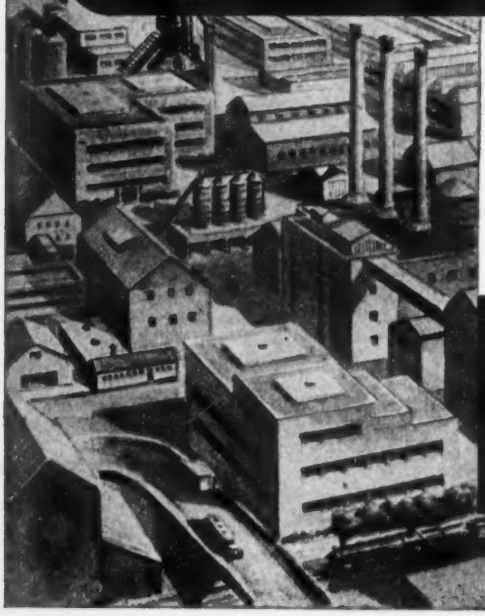

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This test helps to solve combustion problems, reveals how fuel can be conserved, and the quantity and quality of the product increased.

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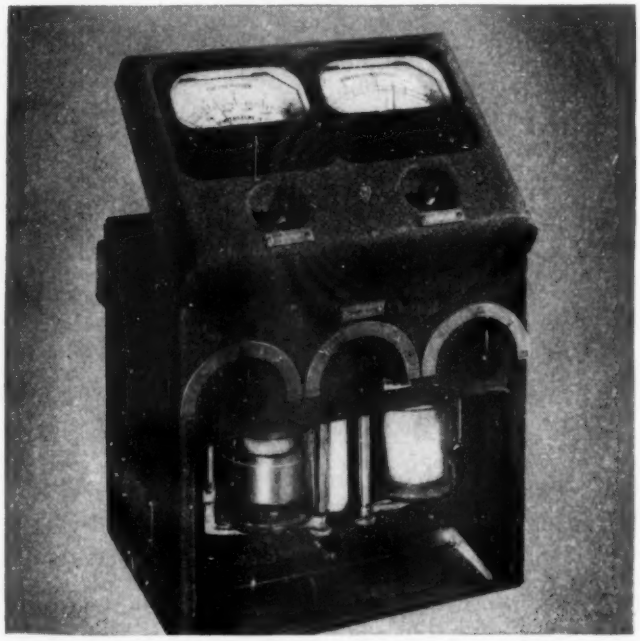

THE CITIES SERVICE INDUSTRIAL HEAT PROVER—a new, accurate combustion analysis instrument—developed by the Cities Service Research Division to enable those engaged in the oxygen control of furnace atmospheres to achieve greater combustion efficiency at less cost.

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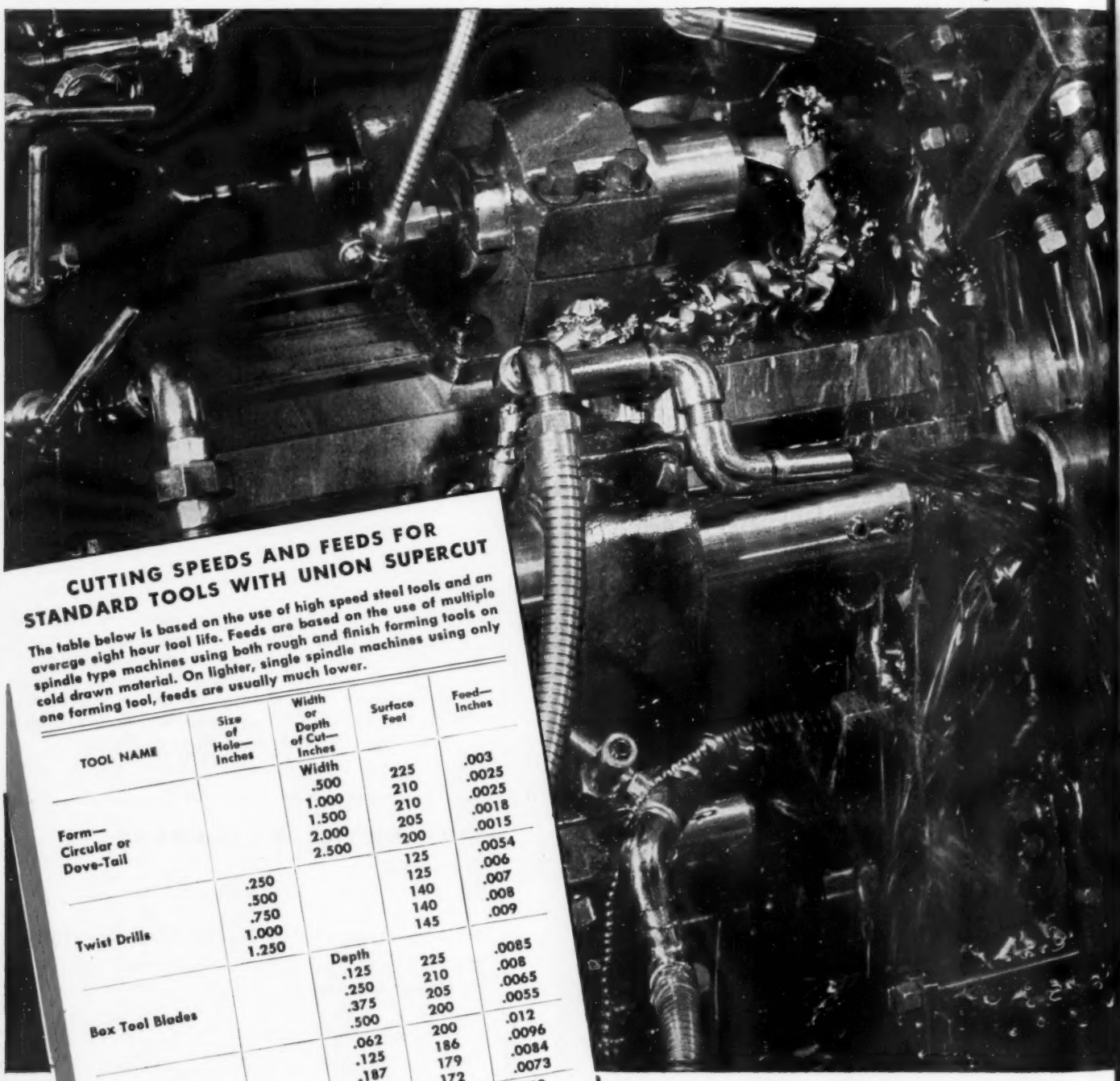


CUTTING SPEEDS AND FEEDS FOR STANDARD TOOLS WITH UNION SUPERCUT

The table below is based on the use of high speed steel tools and an average eight hour tool life. Feeds are based on the use of multiple spindle type machines using both rough and finish forming tools on cold drawn material. On lighter, single spindle machines using only one forming tool, feeds are usually much lower.

TOOL NAME	Size of Hole—Inches	Width or Depth of Cut—Inches	Surface Feet	Feed—Inches
Form—Circular or Dove-Tail		Width .500 1.000 1.500 2.000 2.500	225 210 210 205 200	.003 .0025 .0025 .0018 .0015
Twist Drills	.250 .500 .750 1.000 1.250		125 125 140 140 145	.0054 .006 .007 .008 .009
Box Tool Blades		Depth .125 .250 .375 .500	225 210 205 200	.0085 .008 .0065 .0055
Hollow Mills		.062 .125 .187 .250	200 186 179 172	.012 .0096 .0084 .0073
Knurl Tools In Turret { On Knurl—Cross Slide { Off			225 225 225 280	.020 .040 .020 .008-.010
Chamfer & Facing				180 180	.0085 .012
Reamers	under 1/2" 1/2" or over				
Cut Off		Width .062 .125 .187 .250	225 230 235 250	.003 .0035 .0035 .004

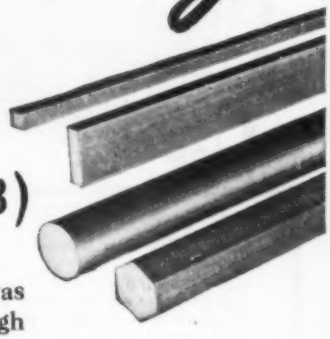
....You'll Find This Data in Your Steel Handbook No. 42

—and you'll find a lot of other information, too, in this helpful book for machine tool users. It provides recommended speeds and feeds for other steels, analyses, physical properties, heat treatment, spindle speeds, weight and area tables, stock estimating tables, etc. Use your handbook and Republic Union Cold Drawn Steels to help keep war production curves on the upward swing.

Steel Available Today-

UNION SUPERCUT

(Free-Machining Bessemer • A.I.S.I. B 1113 • S.A.E. 1113)



Production efficiency has jumped to new highs. Valuable time lost by shut-downs for too-frequent tool changes has been saved. Increases in output of 50 to 100% have not been unusual—with some rising to 200% and higher when equipment and part design would permit. New records have been established for automatic screw machine output. All because of the development and constant improvement of UNION SUPERCUT—the fastest-machining steel available today.

UNION SUPERCUT was the original high-sulphur Bessemer Screw Steel. The present product bearing this name is the result of improvements made time after time as laboratory research and shop experience indicated how its combination of high machinability, fine machined surface and long tool life could be bettered.

This free-cutting steel is *uniformly* machinable bar after bar and shipment after shipment. It retains all the physicals of high-quality Bessemer Steel. It is remarkably free from abrasive elements that dull tool edges. It machines to a smooth, bright finish—produces full, sharp threads and accurate, small details. It may be used for cyaniding and carburizing on parts for which Bessemer Steel is suitable.

UNION SUPERCUT was developed primarily for high speed machining—and thus finds its greatest use on late model "automatics". But, because of its ability to take heavier feeds, it sometimes may be employed efficiently on slower equipment. Where high cutting speed is not necessary, however, its companion steel—UNION FREE CUT—will provide the same qualities with the exception of machining speed.

Like all *Republic* UNION COLD DRAWN STEELS, which include also the open-hearth and electric furnace analyses for applications requiring higher physicals, UNION SUPERCUT and FREE CUT are processed to provide steel parts producers with bars which will enable them to obtain highest production efficiency and greatest output of perfect parts at lowest cost per piece.

And Union Drawn metallurgists and engineers are ready to help you achieve those goals in your plant.

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McCASKEY—PRODUCTION CONTROL THAT KEEPS PRODUCTION MOVING

Shown here is a typical installation of McCaskey Production Control and a suggestion of what it accomplishes specifically in the plant of Federal Manufacturing & Engineering Corporation, Brooklyn, N. Y. This company, prior to Pearl Harbor, manufactured the nationally known Federal Photographic Enlarger. Today, its five hundred employees are busy 100% on war work.

The Army-Navy E award, followed recently by the White Star, is indicative of the high standard of production efficiency set and maintained in this plant.

To quote Mr. E. N. Reynolds, Manager of Production and Planning Control, "Our jobs are constantly changing. McCaskey Production Control provides such flexibility that, regardless of the length of the job, we know where production stands at all times. It gives us a constant check of every phase of production, movement of materials and operations."

(Above)—Central control of production providing the status of every part in process by operations and departments. Prompt collection and filing of copies of time and move tickets with shop orders, constitute a record that is complete and up-to-the-minute. Orders that are behind schedule stand out as requiring special attention. A glance at the Control Boards gives a complete picture of the progress of any job in the shop without reference to any other source of information.

(Left)—One of several departmental controls where employees receive job assignments and individual time tickets and corresponding shop orders are retained, showing the job on each machine and the following job or jobs. Also provides foremen with simple means for assigning jobs to employees and machines best adapted for them, in accordance with schedule requirements.

(Right)—Job costs and inventory of parts placed in stock, awaiting completion or assembly. Costs are secured by accumulating copies of job time tickets provided without extra writing, eliminating the clerical operation of making a posted record. Inventory data are recorded by filing copies of tickets issued to accompany parts moving to stock. "One writing" and visible filing provide these essential records with a great saving of time and clerical work.

A McCaskey representative will gladly explain how a McCaskey Production Control System can be applied in your plant to speed production.

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

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McCASKEY INDUSTRIAL CONTROLS

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Gulf Quality Lubricants provide an extra margin of protection against excessive wear and resulting mechanical troubles—help keep machines producing at top wartime speed and efficiency—are good production insurance.

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Gulf Cutting Oils—in plant after plant Gulf Cutting Oils have set new standards for production, tool life, and work finish—up to 400% increase in production per machine, up to 2000% longer tool life, and outstanding improvement in finishes.

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IF you have a problem in any way connected with the use of a petroleum product, Gulf is well prepared to give you effective help in finding the answer. For the Gulf organization combines petroleum manufacturing knowledge and skill with broad practical experience in the varied production, processing, and maintenance problems of industry.

Call in a Gulf Service Engineer today and get the benefit of his helpful counsel. His recommendations may enable you to improve production—both in quality and quantity—and reduce manufacturing costs.

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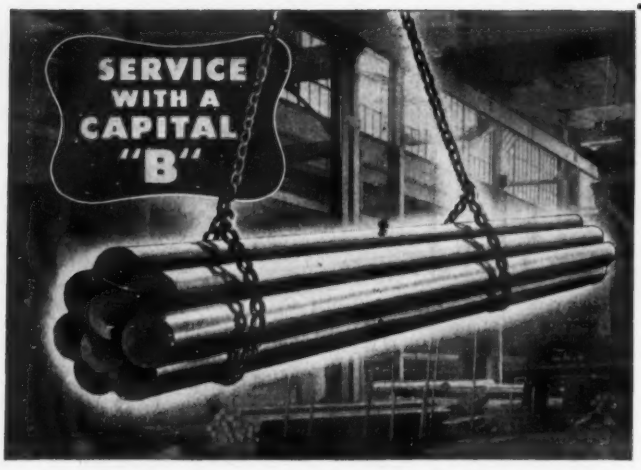

The "B" stands for Bissett, of course, for it was Bissett service which made possible the prompt delivery of the bored shafts shown above. These 9 shafts—14 feet long with 7½" O.D. and 4" I.D. —were supplied to a war plant completely machined, heat treated and ready for use.

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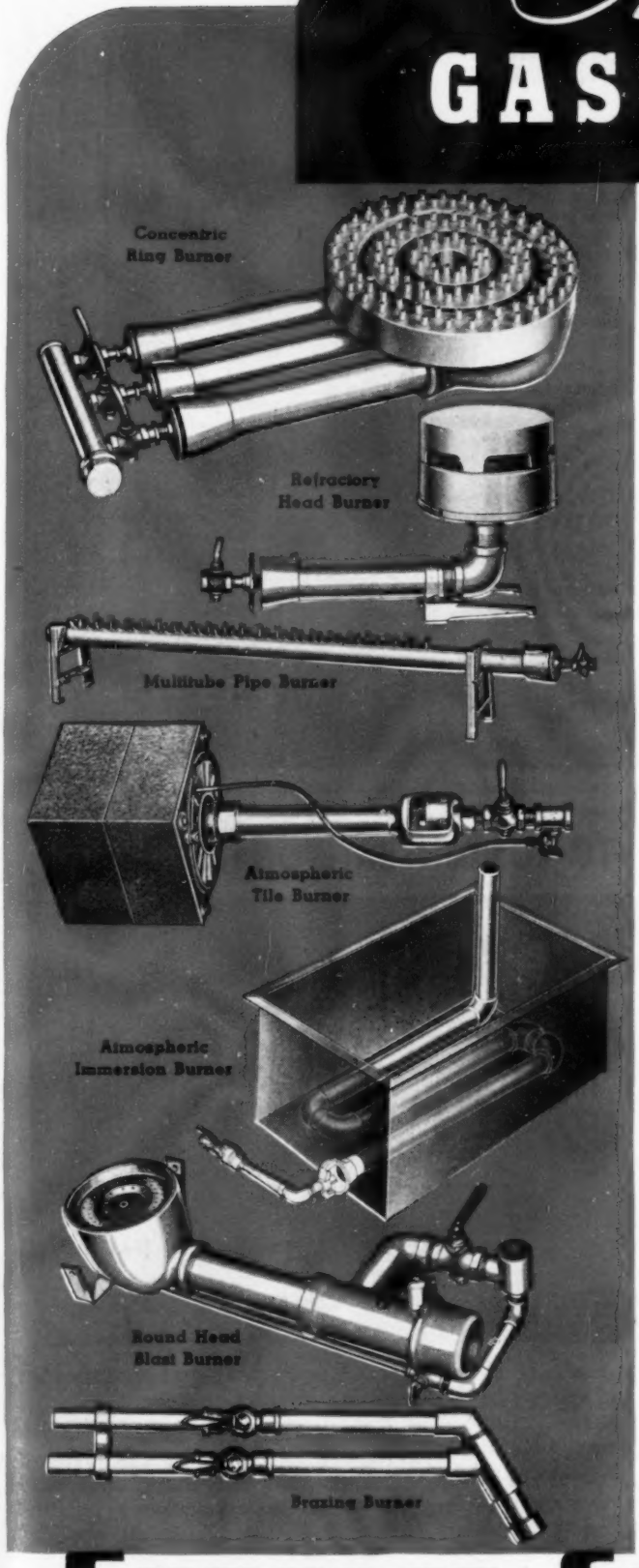

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Among the 170 different Surface Combustion burners,—with a wide range of sizes and types available —a burner can be found to meet the requirements of that unusual application you may have.

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Tool life greatly increased by reconditioning cutting oil *with* BARRETT OIL EXTRACTION SYSTEMS

Reports from plants using Barrett Oil Recovery and Reconditioning Systems show surprisingly high percentages in increased tool life. Then, too, users are enthusiastic as to the improved condition of the reclaimed oil as well as the high returns on the investment. Some set-ups in plants engaged on defense production have paid for themselves in a few months.

The Barrett Centrifugal Oil Extractor—which is part of a complete system—recovers 100% of the removable oil or 98½% of the contained oil from chips and turnings in 2 minutes or less. Complete Barrett oil recovery and reconditioning systems include Extraction, Sterilization and Sedimentation, together with filtration. The units involved are available in various sizes, individually or as a group, and are available with full manual control, semi-automatic control or with full automatic control requiring only loading, unloading, starting and stopping of the extractor by the operator. Complete plans including storage tanks for reclaimed oil or for use in conjunction with existing equipment are also available.

With the Barrett system, abrasive-free oil assuring longer tool life can always be depended on. With Barrett Sterilization and Sedimentation equipment, cutting oil is also safe and free from contamination.

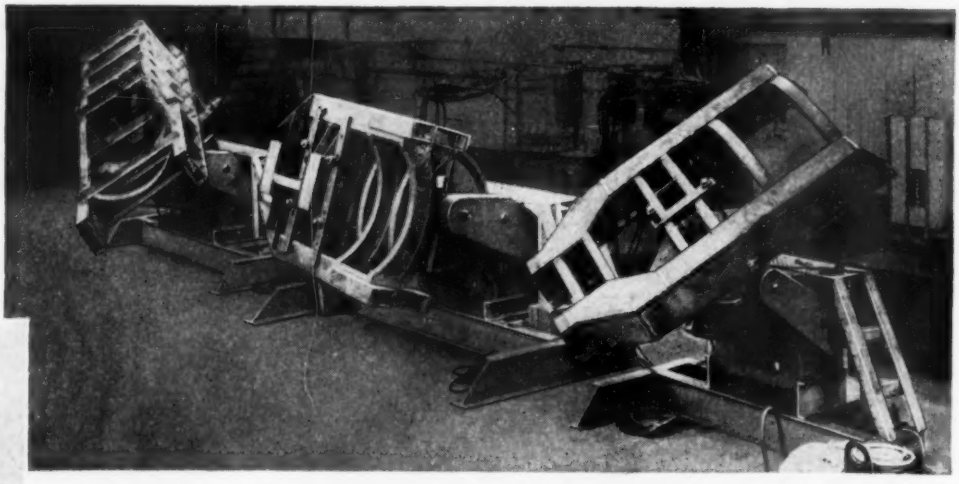
Investigate Today by Sending for Descriptive Bulletin of Oil Recovery and Reconditioning Systems

Barrett Centrifugal Oil Extractor—the heart of Barrett Cutting Oil Recovery and Reconditioning Systems.

THE LEON J. BARRETT CO., WORCESTER, MASS.
Designers and Builders of Centrifugal Machinery

POSITIONING PERMITS YOUR WELDERS TO CONCENTRATE ON WELDING...

In handling these cumbersome frame assemblies, the welders can swing them through 360° and tilt them as far as 135° beyond horizontal. Both men and women welders like Ransome equipment because it steps up their production and reduces fatigue.



6,000-lb. capacity unit.

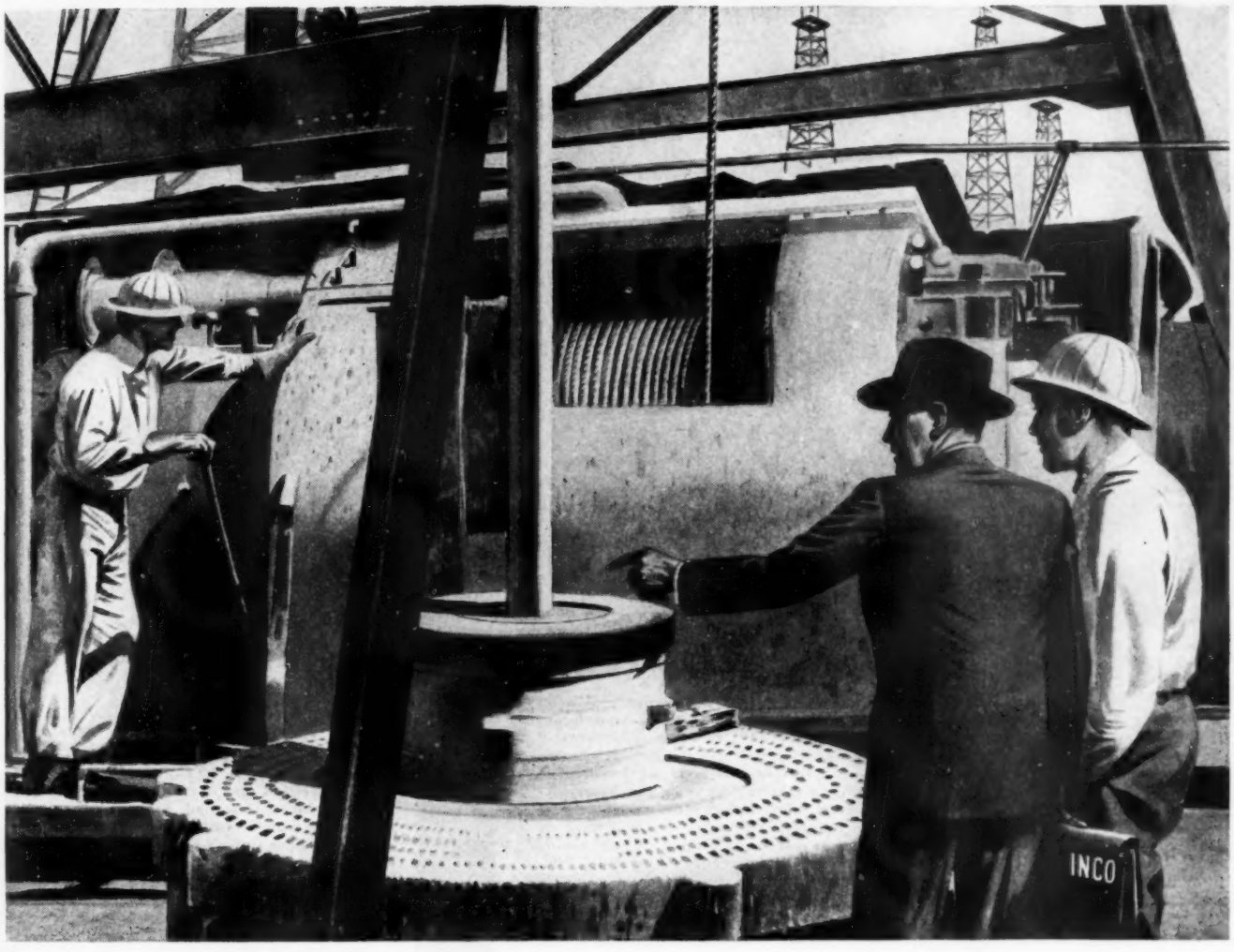
It's certainly not good business to waste welders' time and energy in "rasseling" the work around . . . not when a Ransome Positioner will do the job at the touch of a switch.

This equipment improves quality by providing the correct downhand position for every weld, saves valuable floor space, promotes safety, and speeds up welding production generally.

There's a type and size for *your* welding needs . . . in a line that extends from light-duty hand-operated up to 40,000-lb. capacity.

» Write for full information.

Ransome WELDING POSITIONERS
INDUSTRIAL DIVISION • RANSOME MACHINERY COMPANY • DUNELLEN, NEW JERSEY



NICKEL AIDS THE PETROLEUM INDUSTRY

to KEEP 'EM PRODUCING!

Oil is ammunition. On every battle front, oil is war material number one.

Besides power for ships and subs, planes and tanks, trucks and jeeps, it also provides the basic ingredients for synthetic rubber, toluene for TNT, chemicals, and many other essential war materials.

To meet increased wartime demands for oil, field and pipeline equipment carries heavier loads. Refineries make longer runs at high heats and pressures. Engineers add sub-zero cycles and new catalysts. Equipment is taxed up to and sometimes beyond rated capacity . . . precision equipment that cannot be readily replaced.

Despite emergency schedules, however, that equipment rarely fails. For, since the days when shallow wells were drilled with wooden rigs and kerosene was shipped in oak barrels, oil men have relied largely on stressed parts strengthened and toughened by additions of Nickel.

The oil industry knows many uses for Nickel alloyed materials, from crown blocks to drill bits, from sucker rods to pressure stills. Alone, or in combination with other alloying elements, Nickel helps metals resist corrosion, retard wear and absorb shock overloads. Properly used, a little Nickel goes a long way to insure dependable, uninterrupted operation of production and refining units.

For years the technical staff of International Nickel has been privileged to cooperate with petroleum engineers whose pooled information and "know-how" are now so vital to Victory. To men in all industries who desire assistance in the selection, fabrication and heat treatment of ferrous and non-ferrous metals, INCO engineers and metallurgists offer counsel and data.

New Catalog Index

New Catalog C makes it easy for you to get Nickel literature. It gives you capsule synopses of booklets and bulletins on a wide variety of subjects — from industrial applications to metallurgical data and working instructions. Why not send for your copy of Catalog C today?

* *Nickel* *

THE INTERNATIONAL NICKEL COMPANY, INC., *67 Wall St., New York 5, N. Y.*

Why

Rapid Fabrication of Large Parts

Molding has always been one of the fastest and most economical methods of producing plastic parts in quantities. But through a recent development of Bakelite Laboratories—Heatronic Molding—the technique of molding has been accelerated still further. Heatronic Molding employs electrostatic heating of thermosetting materials, so that heat is generated uniformly *within* the charge of molding material by high-frequency current. Curing time can be reduced 10 to 50 per cent, and molding pressures lowered by 30 to 40 per cent. Large-sized parts never before possible can now be produced on standard presses. For the first time, the compression molding of pieces thicker than ⅜ inch from thermosetting materials becomes commercially practicable. And, now, the impact-type phenolic plastics can be molded as readily as the general-purpose phenolics.

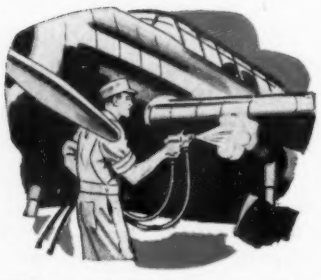
Manufacturers will immediately recognize the opportunities this process offers in the production of such large equipment as washing machines. The entire tub-and-gear housing could be completely formed as one unit, in a single operation, using the same sturdy and water-resistant plastic adopted for washing machine agitators. It would be strong and durable, yet light in weight. It would have highly desirable heat-insulating characteristics, and would be inert to caustic solutions.

TOUGHNESS for thin sections...

The development of plastic bayonets for Navy training purposes demonstrates the high tensile strength and flexural strength obtainable even for thin-walled parts when they are molded from BAKELITE Molding Board Materials. These impact-resistant plastics are supplied in sheets of various sizes, or in shapes cut to the approximate design of the finished parts. The blanks, as they are then called, are virtually preforms, which can be used in molds designed for general-purpose phenolics. Products can be made entirely from these materials, or the molding boards and blanks can be used with standard types of phenolic plastics to provide reinforcement at vital points.

LOW-COST metal replacement...

By adapting the plastic printing plate development of Bakelite Laboratories to the production of instrument control panels, one manufacturer is conserving impressive quantities of precious sheet aluminum and even more precious man-hours. A matrix of BAKELITE Phenolic Material is made from an etched copper plate, which serves as the original pattern. Any number of VINYLITE Plastic panels can be molded in this matrix, complete in every detail, and ready for subsequent curving to final shape by heat treatment. The combined use of these two materials assures faithful reproduction in one operation of not only the intaglio lettering, but also the hundreds of through-holes in the panel. It eliminates many operations necessary with metal plates, such as drilling, engraving, slotting, forming, anodizing, and polishing. *(Panels molded by Theo. Moss & Co., Inc.)*



DURABLE coatings that dry in minutes..

By the addition of BAKELITE Dispersion Resins to paint and varnish formulations, drying time can be reduced from hours to minutes. Such coatings, used by the Navy for more than 8 years as anti-corrosive aircraft primers, air-dry in 1 to 5 minutes without blistering or wrinkling, but nevertheless exhibit remarkable durability. Primers based on these resins and exposed, without top coat, for 2½ years on steel panels, revealed no checking or rusting. They have withstood 1,080 hours in a 3 per cent salt solution spray test, while other high-quality primers failed in 90 hours. They have shown no blistering, pimpling, or rusting after 8,000 hours of continuous immersion, whereas other primers failed in 300 hours.

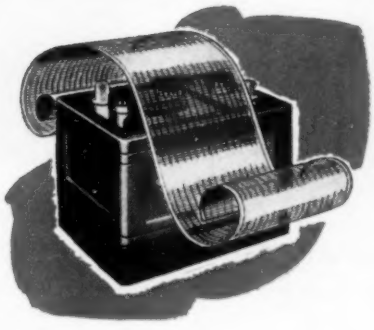
Helpful Literature on Plastics

These are a few of the valuable guidebooks you can obtain by writing to Department 27. "A Simplified Guide to Bakelite Plastics" is a 16-page summary of the principal BAKELITE Plastics now available. It describes each type briefly, and illustrates typical applications. "Bakelite Molding Plastics," a 32-page booklet, provides further information, and ASTM data, on moldable plastics. "Molding Technic for Bakelite and Vinylite Plastics," price $3.50 postpaid, is a 224-page manual on the art of molding plastics—contains comprehensive data that the designer, engineer, molder, and user should have on the design and fabrication of hot-set and cold-set molding materials. Additional pamphlets and booklets describing other types of BAKELITE Plastics are also available.

Plastics ?

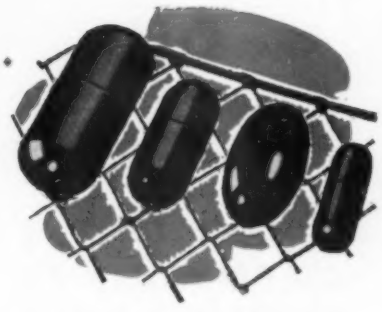
Remarkable DURABILITY for wood...

Stronger and lighter than metal, yet unaffected by extremes of heat or cold, oil, gasoline, and constant vibration, wood impregnated with BAKELITE Resins and molded into three-dimensional forms has become a most valuable structural material in the building of aircraft. Engine cowlings that resist high heat are representative of the many large shapes now molded from wood impregnated with BAKELITE Resin. Entire fuselages and wings can be formed. Sections as long as 84 feet have been successfully produced in torpedo boat construction.



RESISTANCE to corrosive chemicals...

BAKELITE Polystyrene Plastics, in the form of flexible sheeting, are now employed as storage battery separators. Like all other forms of this amazing plastic—molding materials, extruded rods, tubes, and filaments, and resins for surface coatings—the flexible film is unexcelled in its resistance to both alkalies and non-oxidizing acids. Other outstanding advantages of BAKELITE Polystyrene Plastics include: extreme lightness in weight with good mechanical strength characteristics, superior electrical insulating qualities particularly at high frequencies, and high index of refraction when crystal-clear types are employed.



Unusual water RESISTANCE and strength...

Because they are tough and flexible enough to withstand pressures encountered at underwater levels as deep as 1,000 feet, BAKELITE Polyscyrene floats are able to release for other service the galvanized steel sheets formerly used to buoy commercial fishing nets at sea. The polystyrene material is extremely resistant to constant immersion in salt water, and also withstands the chemical solution used in cleaning and renovating the nets.

HARDLY A DAY PASSES but another new industrial development is made possible through plastics, or the usefulness of old, familiar products is increased by these versatile materials. Look for the reason and you'll find that the trend to plastics is much more than a matter of replacing other materials. It's because plastics frequently provide a better product, and generally one that is also more rapidly and economically fabricated.

Certain BAKELITE Molding Materials, for example, can give your products high mechanical strength approaching metals—with only a fraction of the weight of metal, and no need for time-consuming finishing. They can provide inherent corrosion resistance, electrical properties, heat resistance, color, transparency, translucency, or opacity. And a new molding technique now permits large parts to be molded at high speeds and in greatly increased sizes never possible before.

Wood becomes a stable and amazingly strong material when bonded or impregnated with BAKELITE Resins . . . releases steel in building construction . . . can be molded into heat-resistant and weather-resistant forms of varied shapes and sizes. Surface finishes fortified with one type of BAKELITE Resins dry within a minute or so, yet stand up in service far longer than many other high quality coatings that require hours to dry.

But these are only a few of the plastics developments now available to industry, and merely a suggestion of the vast opportunities they offer to designers and engineers. You can keep posted on plastics by keeping in touch with Bakelite Plastics Headquarters. Our Engineering Staff and Development Laboratories offer their full co-operation in helping you adapt a growing variety of plastics and resins to your essential needs. As a first step, write for the helpful literature shown here. Please address Department 27.

BAKELITE CORPORATION, 30 E. 42ND ST., NEW YORK
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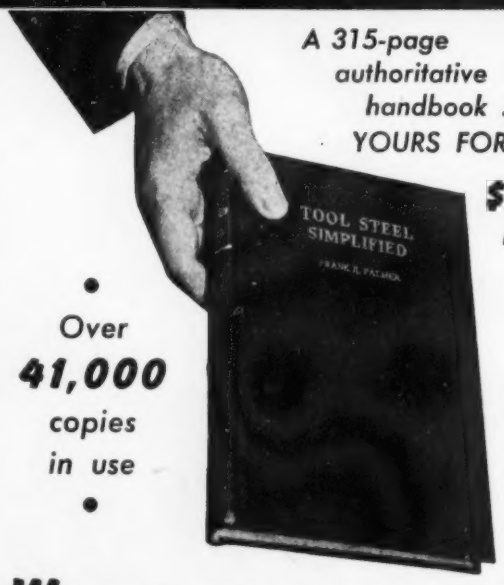

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3. The Analysis of Tool Steel
4. The Soundness of Tool Steel
5. The Timbre (Personality) of Tool Steel

PART II — SELECTING THE RIGHT TOOL STEEL FOR EACH KIND OF TOOL

6. The Matched Set Method
7. The Nine Matched Tool Steels
8. The Matched Set Method in Use

PART III — PROPERTIES, HEAT TREATMENT AND TESTING OF TOOL STEEL

9. Heat Treating Methods and Equipment
10. Hardness and Toughness Testing
11. Properties and Heat Treatment of Nine Matched Tool Steels

PART IV — THINGS WORTH KNOWING

12. Relation of Design to Heat Treatment
13. The Hot Acid Etch Test
14. The Timbre Test
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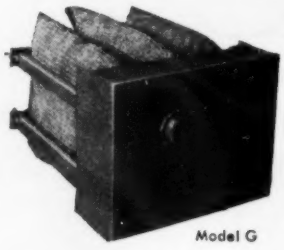
COOLANT STRAINER

The Inexpensive Efficient Coolant Strainer

(U. S. Pat. 1676191—Other Pats. Pending)

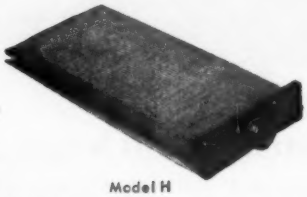


Model G

METEX Coolant Strainers in machines equipped with gear pump coolant systems (or centrifugal pumps with intake pipe in tank) strain chips and slag from coolant. Protect pumps, gears. Prevent excessive machine wear and defective workmanship due to scoring, etc. Insure constant circulation of chip-free coolant fluid. Easily installed, singly or in multiple, in most machines.

Models G and H

are constructed to remove fine residue (grindings, lint, etc.) from coolant fluid. While designed particularly for grinders and automatic screw machines, they give efficient service in all machines. Model H is especially adapted to those with shallow or narrow sumps.



Model H

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VULCAN *Means Close Temperature Uniformity in*

SALT BATH FURNACES

Oil or gas fired, or electrically heated by means of external resistance heaters or immersed electrodes.

VULCAN Salt Bath Furnaces assure fast, uniform heat treating of ferrous and non-ferrous metals, and alloys, in sheets, rods, coils or fabricated shapes. A temperature uniformity of 3° plus or minus can be readily maintained.

We can promptly furnish oil, gas or electric heated Box Type or Pot Type furnaces using salt or lead as the heat conducting medium. Our broad experience enables us to recommend equipment that will produce the desired results economically.

Your request for further information or consultation with our sales engineers will receive prompt attention. Wire, write or phone.

VULCAN CORPORATION

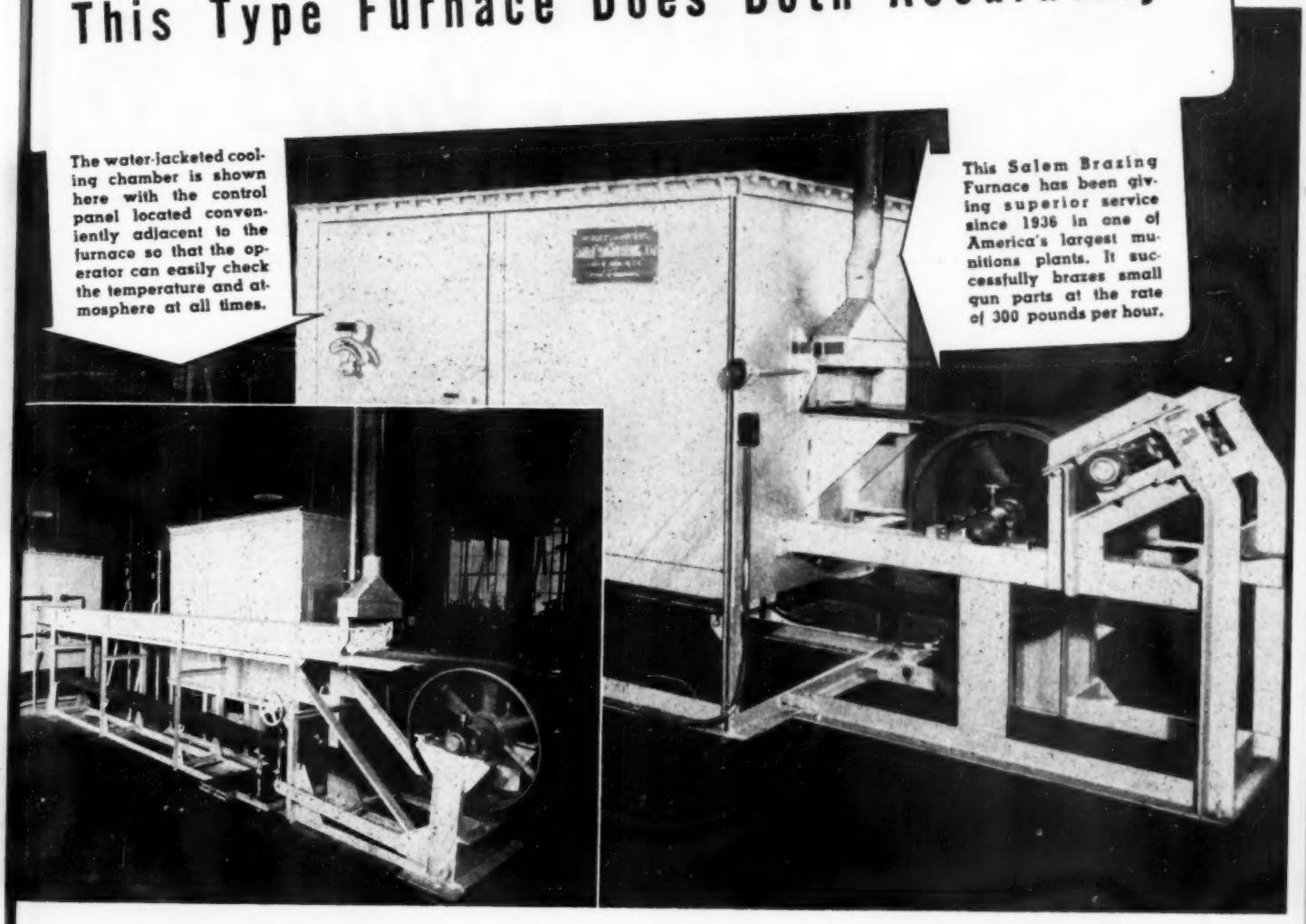
1737 CHERRY STREET, PHILADELPHIA, PA.

HIGH SPEED BRAZING OR SINTERING

This Type Furnace Does Both Accurately

The water-jacketed cooling chamber is shown here with the control panel located conveniently adjacent to the furnace so that the operator can easily check the temperature and atmosphere at all times.

This Salem Brazing Furnace has been giving superior service since 1936 in one of America's largest munitions plants. It successfully brazes small gun parts at the rate of 300 pounds per hour.



THROUGH accurate control of temperature and atmosphere, Salem Brazing Furnaces are readily adaptable to high-production sintering of parts made of powdered ferrous and non-ferrous metals. The type illustrated was designed for brazing small metal parts at accurately maintained temperatures up to 2100° F. The parts to be brazed or sintered travel on an endless alloy mesh conveyor through the furnace and water-jacketed cooling chamber. A special Salem SECO gas generator precisely controls the correct composition of atmosphere throughout the heating-cooling cycle with or without decarburization. Thus whether the parts are brazed or sintered, ferrous or non-ferrous, the proper atmosphere is produced to suit both the process and the product.

Salem Engineers will design special sintering furnaces, either electric or fuel fired, to speed your production. Their research, ingenuity, and years of experience in designing and building all types of heat treating furnaces will be applied to your individual needs. Consult Salem Engineering today on your sintering problems.

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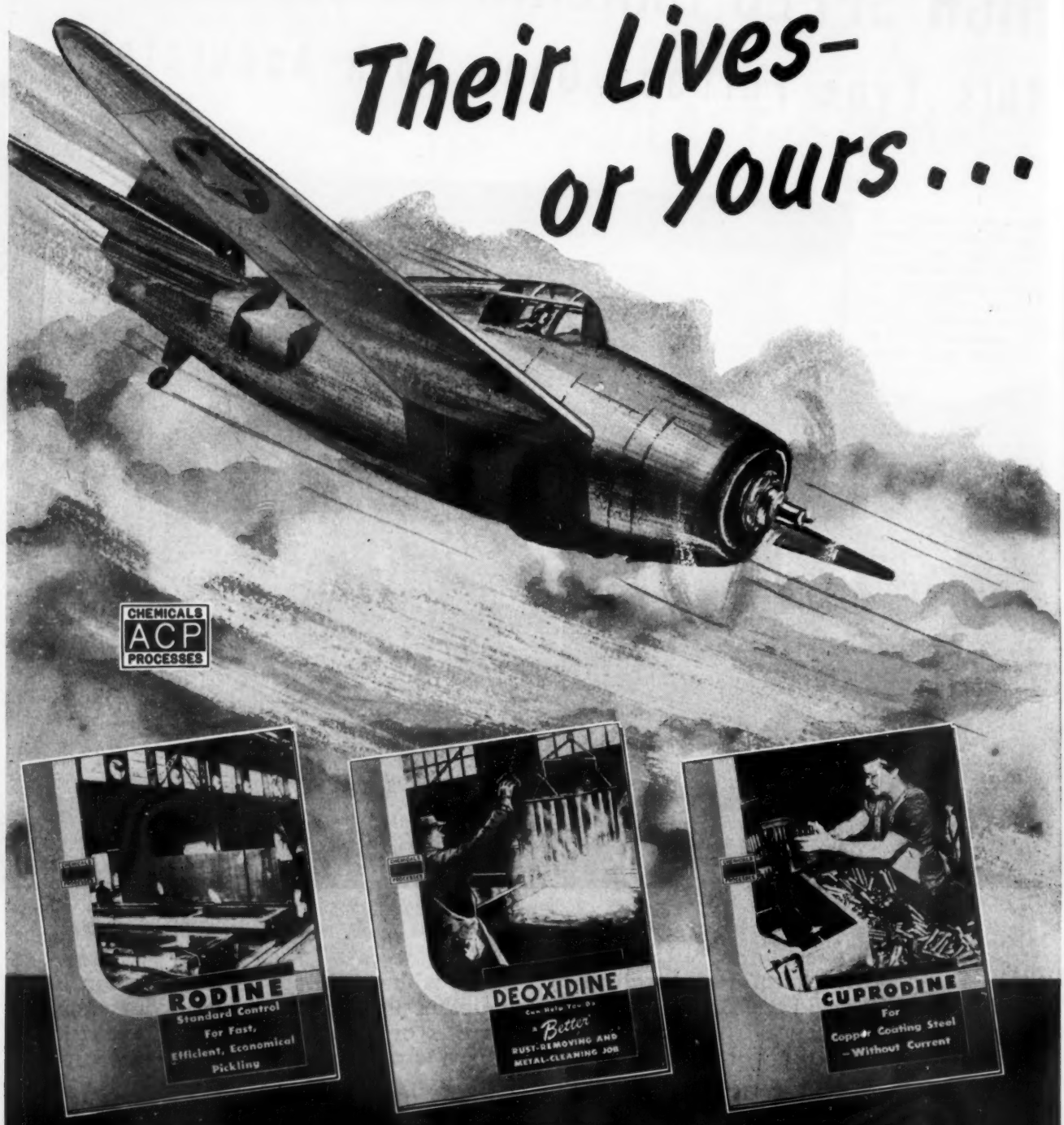
Their Lives— or Yours . . .



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RODINE is a chemical pickle inhibitor effectively controlling the attack of pickling acid on steel without retarding removal of scale or rust. Rodine reduces noxious and corrosive fumes and improves pickling conditions. The Rodine controlled acid bath enables you to clean more metal in less time and eliminates spoilage from over pickling.

DEOXIDINE phosphoric acid type metal cleaner, removes light oil and annealing scale . . . also eradicates rust and rusters. Deoxidine is available for immersion process and for brush or spray application where indicated to expedite production. Deoxidine meets U. S. Ordnance Department requirements for its efficiency in removing rust and neutralizing rust producers before protective finishes are applied.

CUPRODINE has contributed materially in the production of shell cases from steel. The bright, adherent copper coating it produces on clean steel, by simple immersion, minimizes die wear, prevents metal pick up, reduces scratches and breakage in drawing operations. Cuprodizing steel, in metal fabrication, increases the life of dies from five to ten fold.

SPLIT SECONDS COUNT

Every metal part in plane, gun or shell must be flawless—lives are at stake.

From steel mill to finishing room ACP Chemical Products are helping to produce better finished parts, at greater speed, with fewer losses in spoilage and at a substantial saving in labor and materials.

These processes are old. Chemicals have, however, been developed to adapt them to speeding the production of war materiel. There is no need to experiment on your part—each has proved its ability to save time and manpower and produce better results. Send today for one or all of these descriptive folders.

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produces a dense, adherent, stone-like coating of zinc phosphate on galvanized iron and other zinc or cadmium surfaces which forms a lasting bond between paint and metal. Lithoform is recognized by the U. S. Army and Navy as a proper method of preparing galvanized and zinc coated surfaces for paint.

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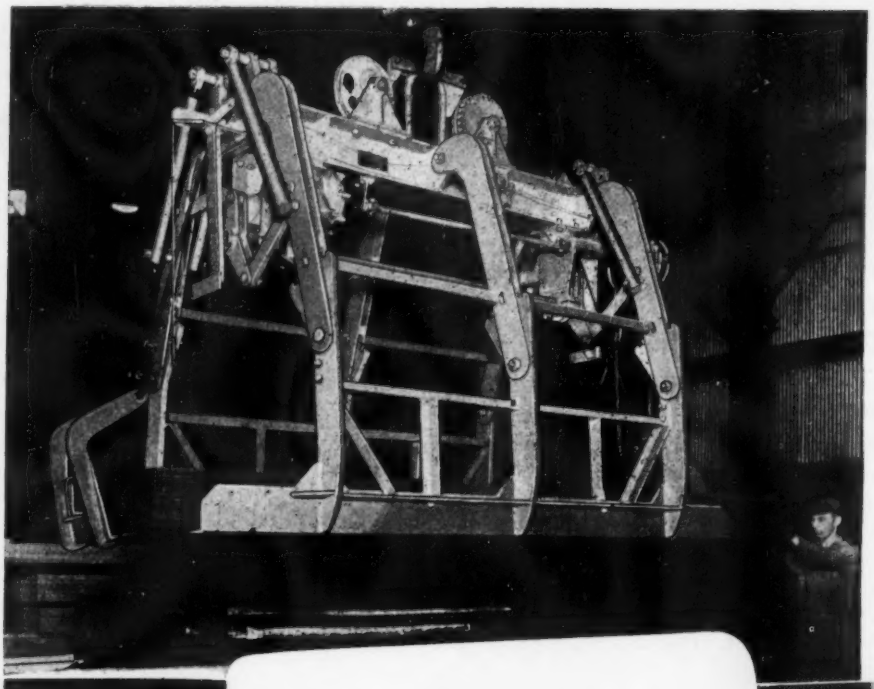

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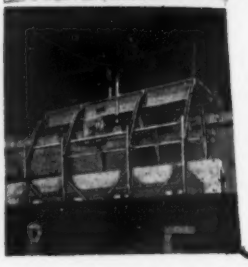
With a C-F Sheet Lifter 1-man can handle the thinnest stock or longest strips quickly and easily—can pick up loose or bundled sheets, carry them safely and stack them closer and higher without slipping or sliding, bending or kinking, without denting or rippling edges.

C-F Sheet Lifters are made in a wide range of sizes and types; for any cranes, monorail or hoist; for any headroom or working situation; in capacities from 2 to 60 tons. All have patented "elbow" arms. All are accurately balanced and counterbalanced and are easily operated by 1-man . . . with hand chain or motor control.



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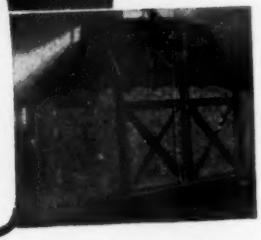

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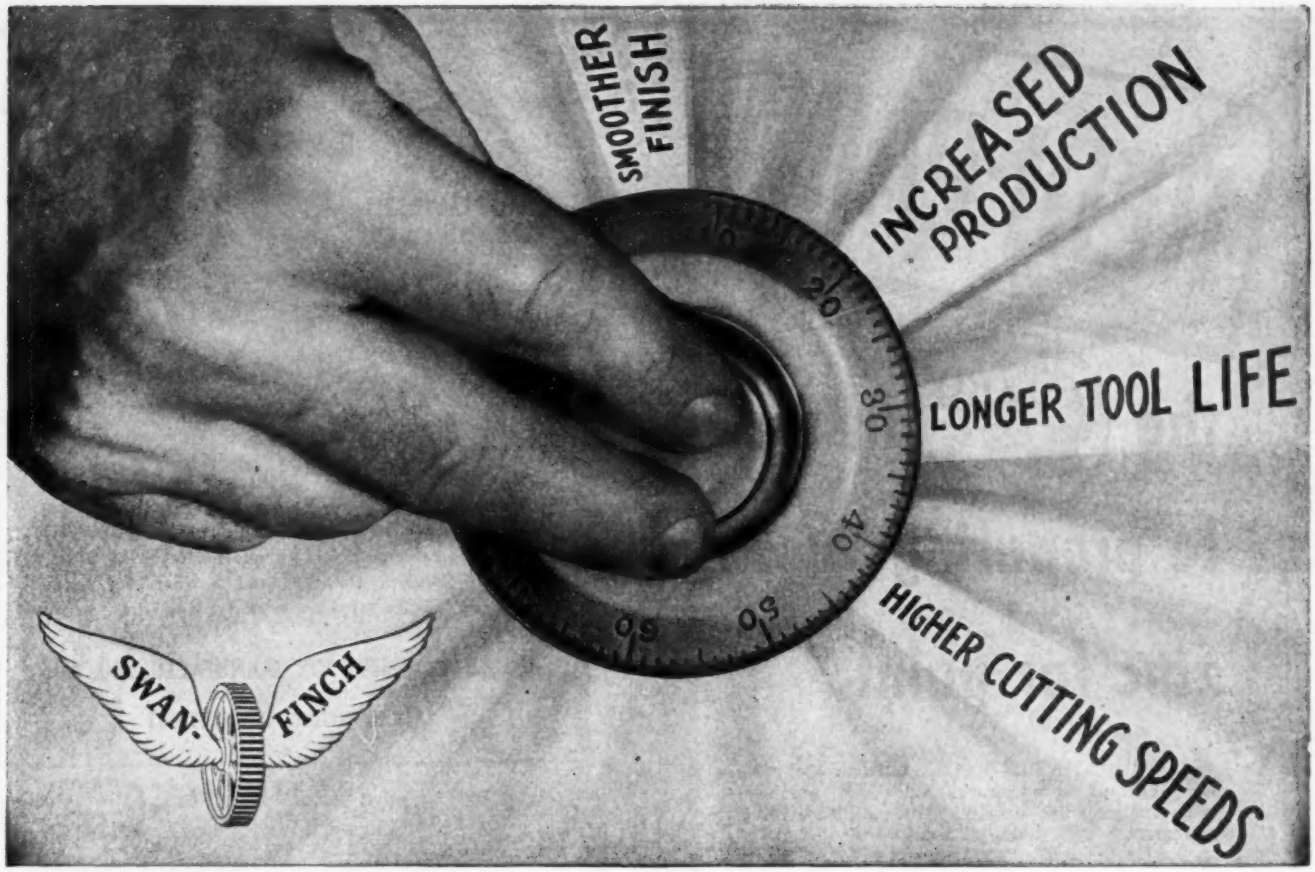

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Right Combinations for increased production!

Right combinations of ingredients in metal working lubricants are like the right numbers on the dial of a safe, each one vital for opening wide the doors of production.

Swan-Finch 'SAFCO' metal working lubricants are combinations that have been continuously proved as scientifically correct.

Today high production schedules and precision specifications do not permit guesswork.

Swan-Finch, the makers of 'SAFCO', are lubrication specialists in the metal working field.

That's why more important plants engaged in vital war production are testing and specifying 'SAFCO' lubricants.

It will pay you real dividends to get better acquainted with the Swan-Finch field representative who covers your district. Capable and able, they are constantly devising *new* ways and means for stepping up production.

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the TURCO answer to preparing "hot" zinc for paint

● TURCO REDI-PAINT passivates "hot" galvanized or zinc-plated metal, chemically changing the surface so that paint adheres permanently in a smooth, unbroken surface.

Because paint will not adhere to untreated zinc coated metals, passivation is necessary. TURCO REDI-PAINT accomplishes this quickly, easily, economically.

4 reasons to use REDI-PAINT

- 1. No chipping or peeling is possible when the metal is first coated with TURCO REDI-PAINT.
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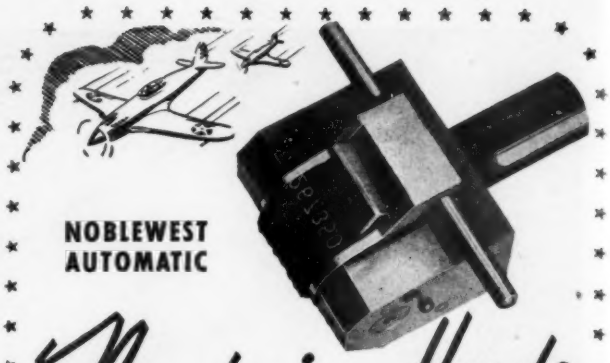

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With men who handle machinery, it's stamina and wear that count in uniforms. So specify this famous fabric when ordering your uniforms.

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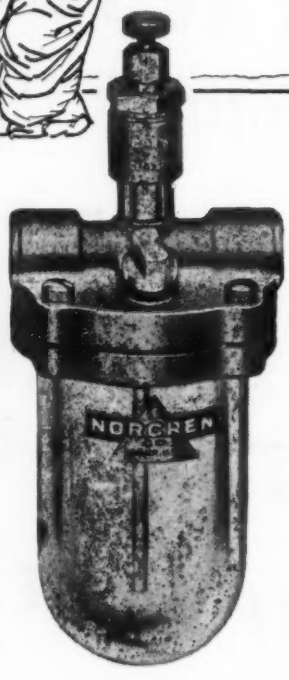

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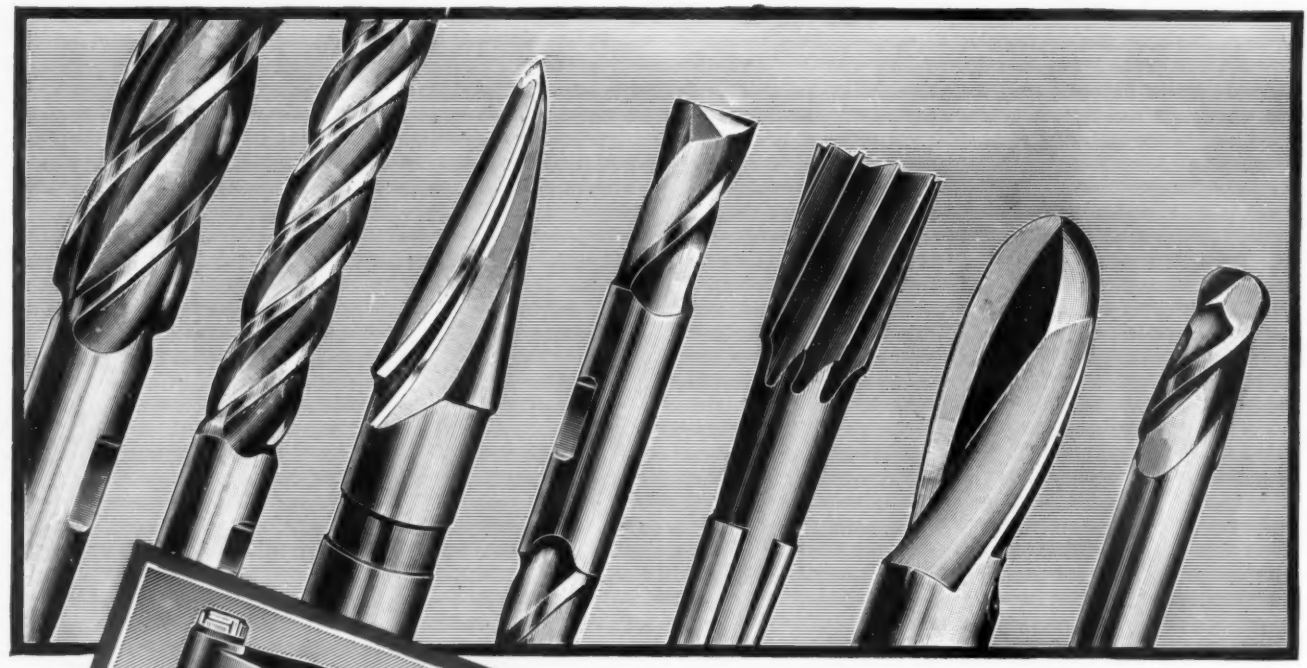

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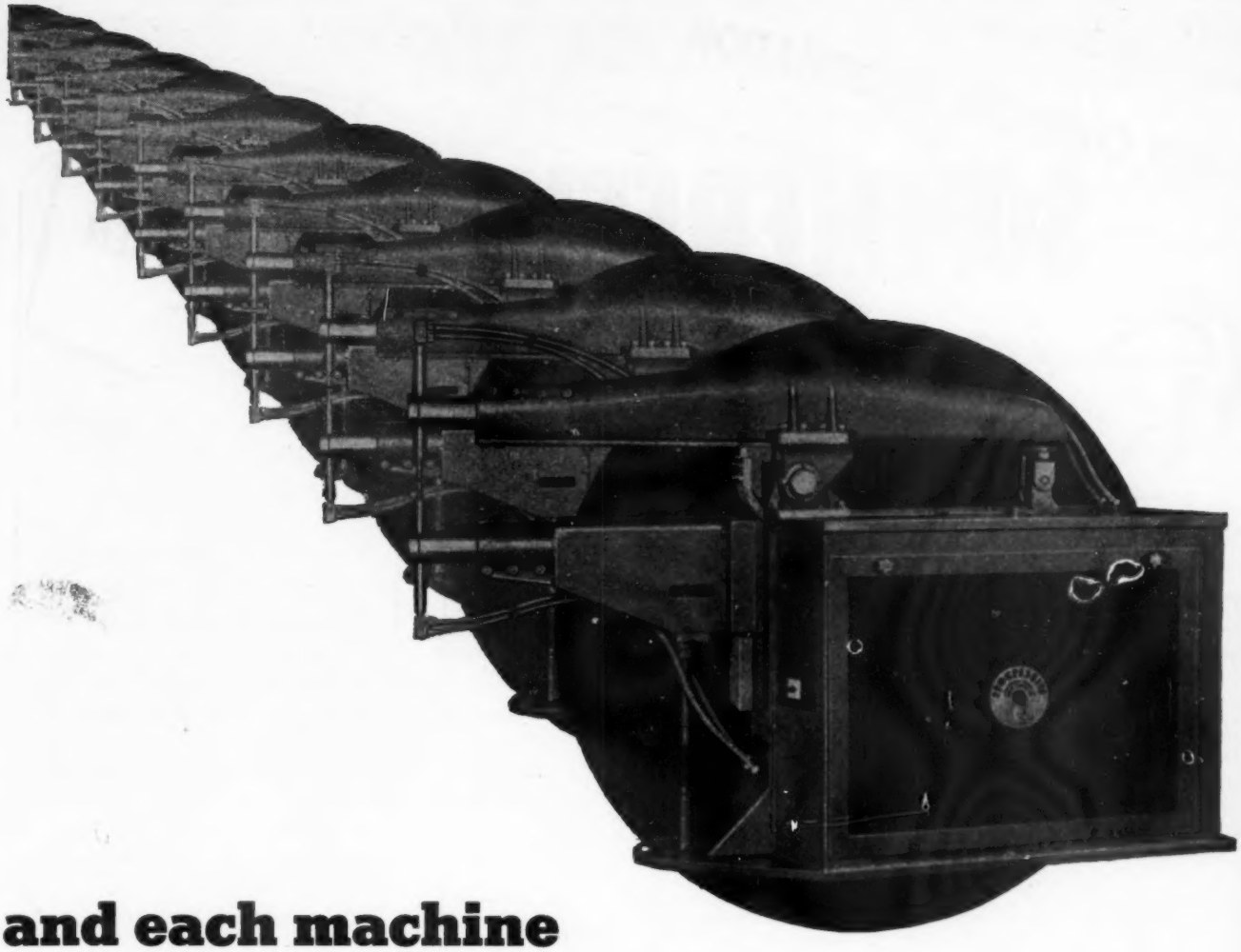

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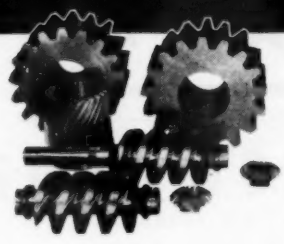
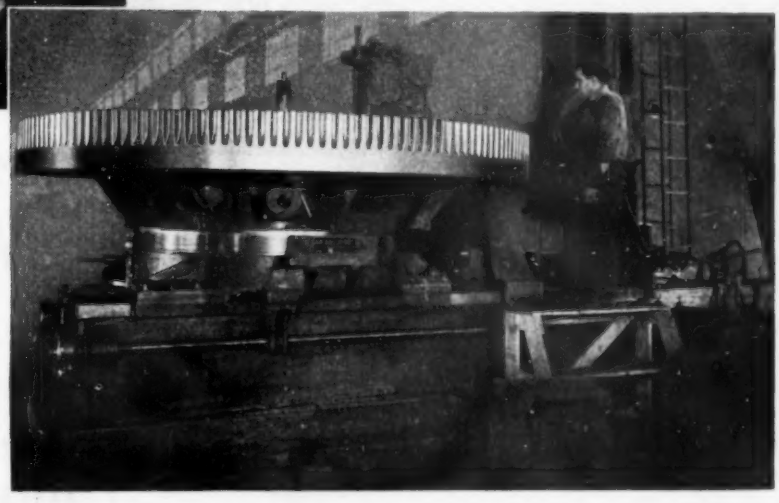


Right:
Cutting a large spur gear in our shop.



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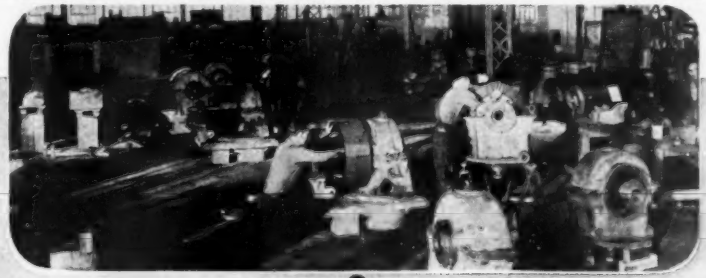

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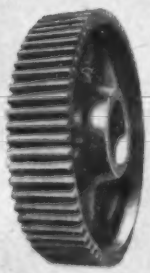
operates all types of valves, etc., safely, economically, from convenient stations.



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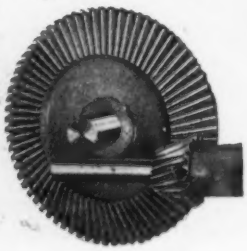

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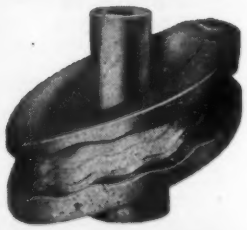

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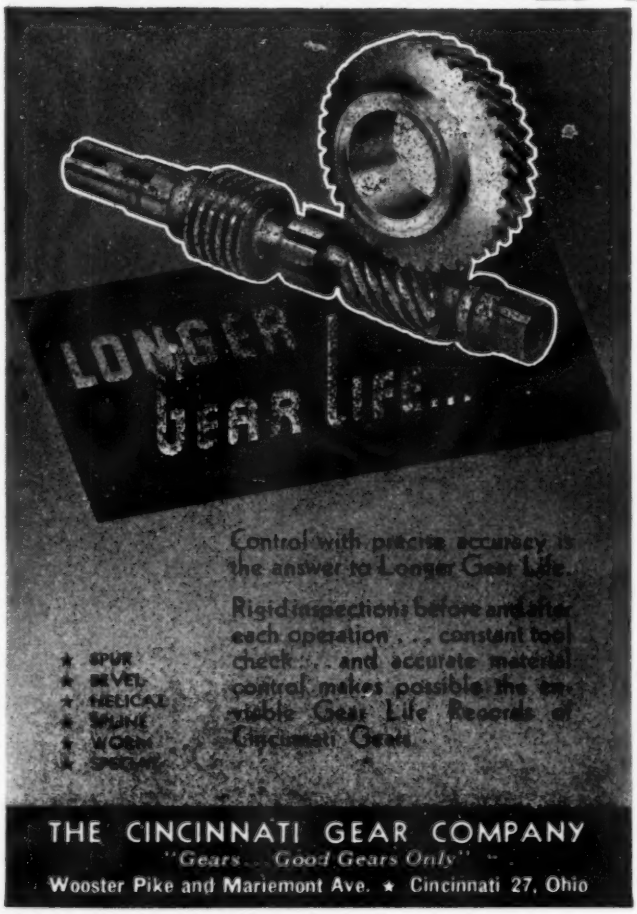
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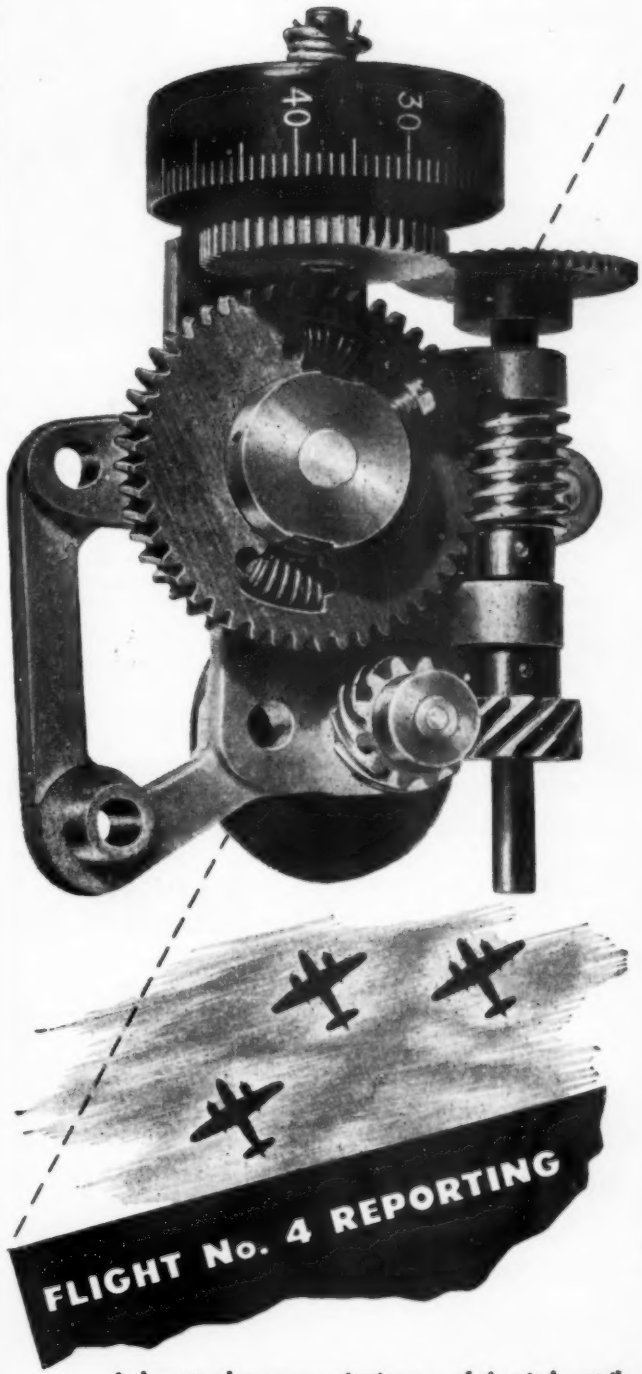

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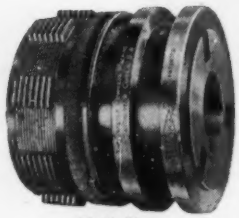

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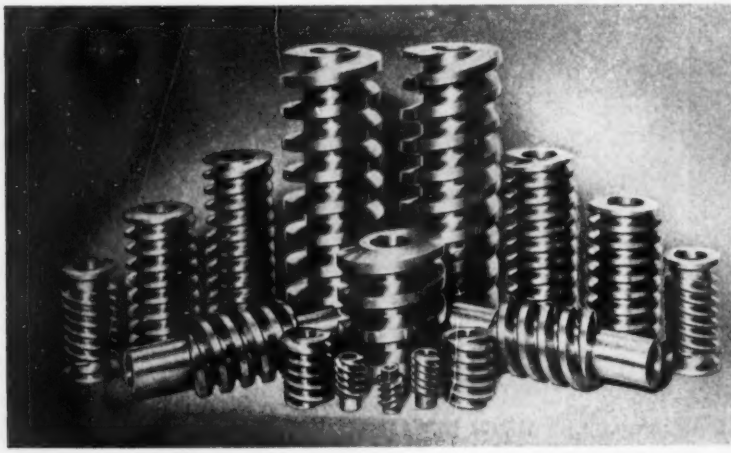

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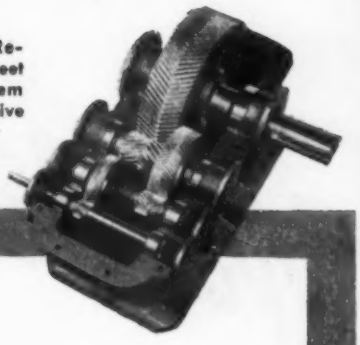

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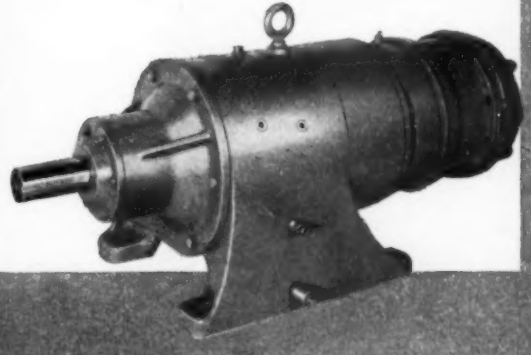

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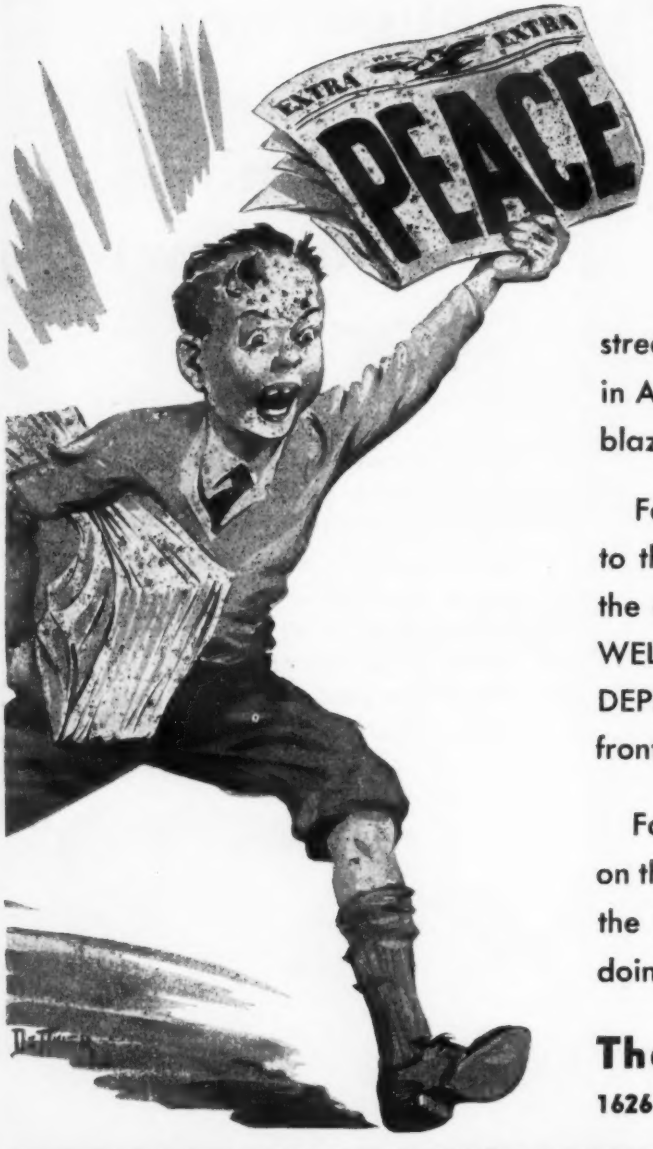
War Will End . . .

BUT PRECISION — NEVER!



Some day — we don't know just when, but we know it's coming — sirens and whistles will let go with full-throated blasts, throngs will fill the streets of every crossroads village and metropolis in America and newsboys will hawk their papers blazoned with a single word — PEACE!

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For WELCO Torque Motors, providing power on the spot where power is needed, will be doing the job for a world at peace just as they are doing it today for the fighting Allies.

The B. A. Wesche Electric Co.
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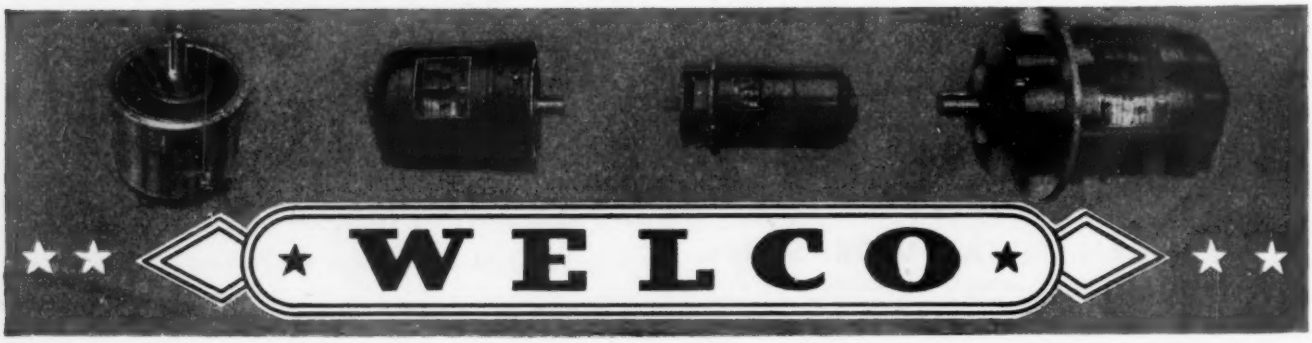

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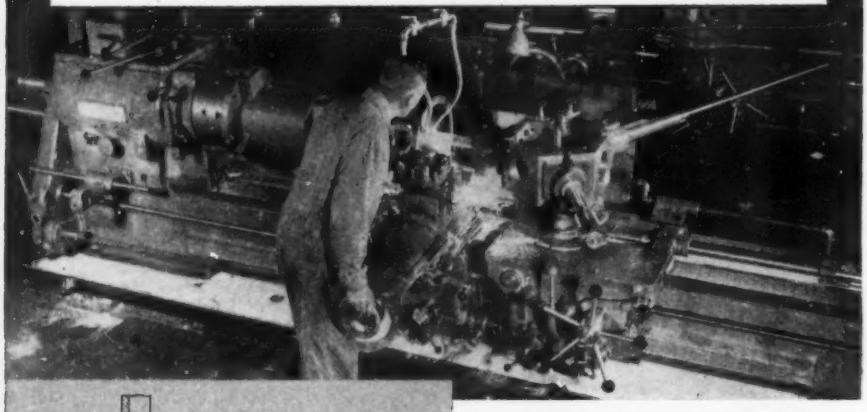
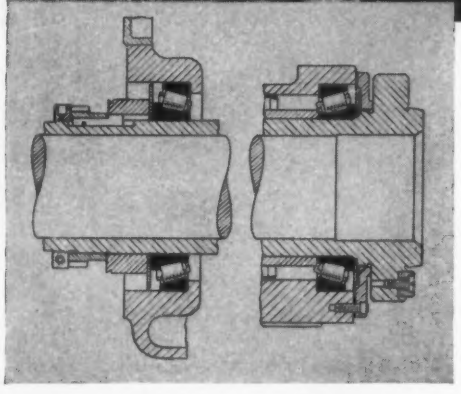
WITH TORRINGTON—BANTAM





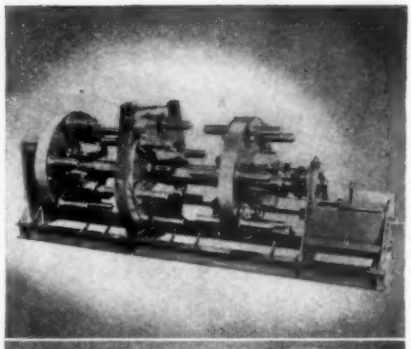
HAIR-BREADTH PRECISION WORK at high speeds is being turned out with turret lathes such as this to help win the battle of production. Built by Gisholt Machine Company, this lathe employs Ultra-Precision Tapered Roller Bearings on the spindles (see cross-section) as an aid in maintaining extreme accuracy. The eccentricity and face run-out of these bearings is .0002 maximum—an outstanding example of the ability of Bantam Bearings Division to build precision bearings for heavy-duty applications.

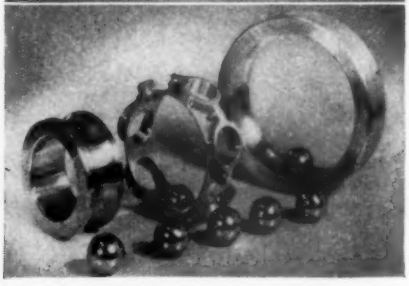
NEEDLE BEARINGS— ALL TYPES—ALL SIZES

NEEDLE BEARINGS TYPE DC are complete, self-contained units consisting of a full complement of rollers and a drawn, hardened outer race. They offer the advantages of small size, low cost, high capacity—and easy installation.

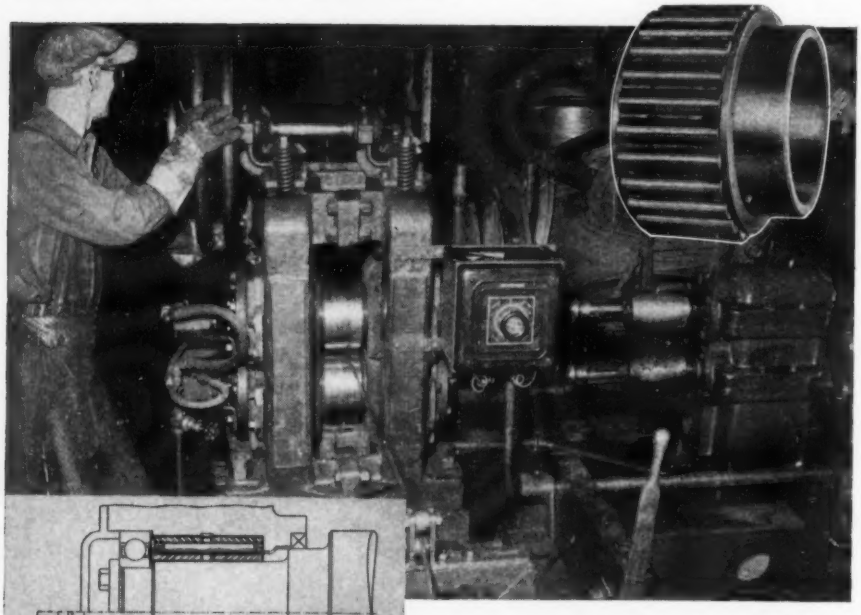
NEEDLE BEARINGS TYPE NCS consist of a full complement of rollers and a relatively heavy hardened outer race. They are furnished with or without inner races. Needle Bearings Type NCS are adaptable to heavier loads than Needle Bearings Type DC.

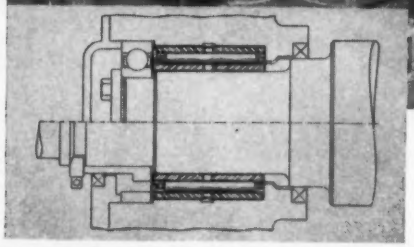
NEEDLE ROLLERS TYPE LN are produced in a range of types and sizes for assembly into low-cost, high-capacity anti-friction bearing units. Our engineering department will make recommendations as to correct size and type selection.





ROTATING 650 POUNDS OF WIRE AT 120 R. P. M. requires spindles of exceptionally high load capacity in wire stranding units built by The Watson Machine Company. Dependability in the main sheave bearings under this severe strain is assured by the use of Ball Radial Bearings. Designed and built by Bantam Bearings Division, these bearings have withstood years of such service without a single replacement.



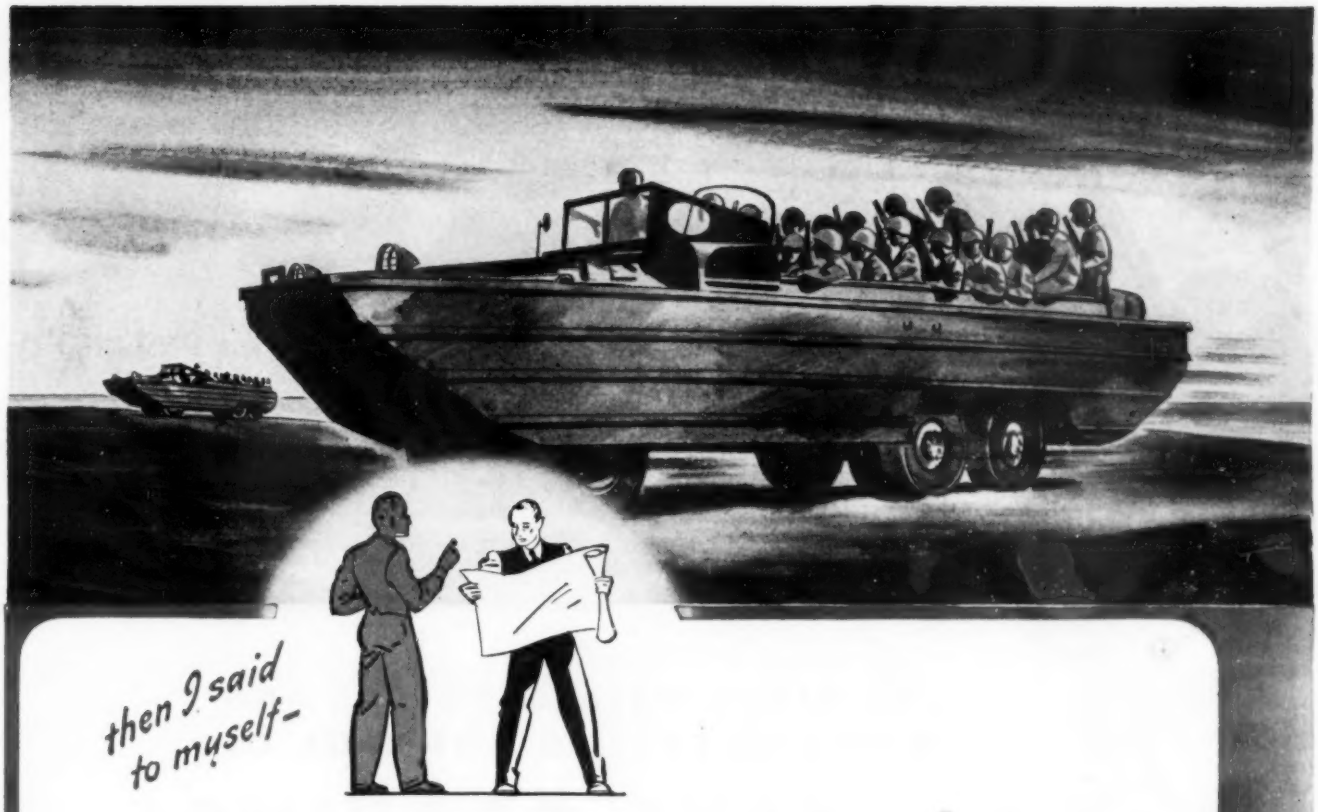


HIGH CAPACITY in a small space is provided by straight radial roller bearings in this 8-inch flattening mill built by Broden Construction Company, while ball bearings, also designed by Bantam Bearings Division, take the thrust load. The bearing arrangement, shown in cross-section, permits compact design.

TORRINGTON BEARINGS

STRAIGHT ROLLER · TAPERED ROLLER · NEEDLE · BALL

THE TORRINGTON COMPANY · BANTAM BEARINGS DIVISION
SOUTH BEND 21, INDIANA



then I said to myself—

Here's How to Reach That Post-war Market Quick

So you want to get the jump on competition — **get to that post-war market first with the most sales features?** *Then take a tip from the Army's amphibious truck—the "duck".*

Well, it is a versatile vehicle—carries troops or cargo across water or land—doesn't even stop in going from one to the other. Say, if only I could do likewise—drive straight ahead without a stop and with all our people aboard—in going from war products to peacetime products.

Then, hop aboard the vehicle used by builders of the "duck", the Liberty ships, the M-4 tanks, the bombers and fighters, and hundreds of other war products. They went from peacetime products to war equipment almost overnight. Their vehicle is WELDING.

Sounds logical. Welding does simplify design . . . quickens tooling up . . . speeds production . . . makes selling easier because it makes products better and cheaper.

And one more suggestion. Learn how to drive this V-day vehicle fast and straight with Lincoln's aid on welded design and procedure. Start NOW.

THE LINCOLN ELECTRIC COMPANY, CLEVELAND, OHIO

THE RIGID METALLURGICAL AND MANUFACTURING CONTROL OF

BUCKEYE BEARINGS

Assures thorough dispersement of all component metals and freedom from porosity resulting in unsurpassed serviceability

● Manufactured from selected metals under Buckeye's complete laboratory control of charging ratios and melting and pouring temperatures, assures the production of a uniformly high quality of product, each piece of which, month after month measures up fully to Buckeye's exacting specifications.

For easy assembly and long efficient satisfactory service, specify Buckeye bearings by brand name. They are furnished fully finished in 1088 ready-to-use stock sizes—in cored and solid 13" bars—in several graphited styles—and in any OD, ID and length, slotted, split, drilled or flanged, exactly to customer's blue-print. No order is too big or too small for Buckeye.

Let us quote on your requirements.

Buckeye

BRASS AND MANUFACTURING COMPANY

BRONZESMITHS SINCE 1900

6412 HAWTHORNE AVE. CLEVELAND, OHIO

BRONZE SLEEVE BEARINGS • STANDARD SIZES OR TO CUSTOMERS' BLUEPRINT IN ANY RECOGNIZED BEARING METAL ANALYSIS

Less Training!

RELIANCE V★S DRIVE

AN ALL-ELECTRIC ADJUSTABLE-SPEED DRIVE FOR A-C CIRCUITS

SPEED RANGES TO FIT THE WORK SIZES 1 TO 30 HP.

This illustrates an application, typical of many, in which Reliance V★S Drive reduces operator training time through the ease, convenience and flexibility of all-electric power control. This simplicity of machine control not only permits greater latitude in the selection of personnel but helps bring new operators up to peak production quicker. For further advantages of Reliance V★S Drive and its varied applications in many industries, send for Bulletin 311.

CALL IN A RELIANCE APPLICATION ENGINEER from our nearest office to work with you on applying electric motor-drive to speed up production, improve quality and reduce costs. These are the things that count today — *and will count tomorrow, too.*

RELIANCE A-C D-C MOTORS

RELIANCE ELECTRIC & ENGINEERING COMPANY

1088 Ivanhoe Road • Cleveland, Ohio

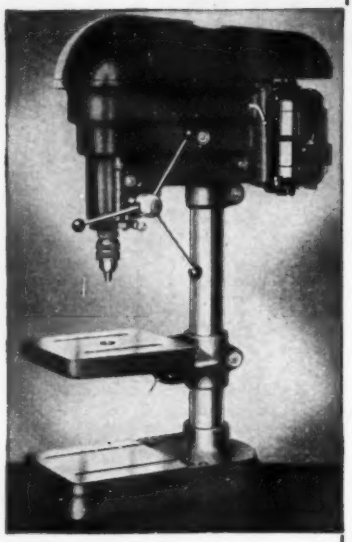
BIRMINGHAM • BOSTON • BUFFALO • CHICAGO • CINCINNATI • DETROIT • GREENVILLE, S. C.
HOUSTON, TEXAS • LOS ANGELES • MINNEAPOLIS • NEW YORK • PHILADELPHIA • PITTSBURGH
PORTLAND, ORE. • ST. LOUIS • SAN FRANCISCO • SYRACUSE, N. Y. AND OTHER PRINCIPAL CITIES

GET BIG PRODUCTION FROM UNSKILLED WORKERS!
Every dollar invested in
BOICE-CRANE SAFETY-ENGINEERED PRECISION-BUILT SHOP-TESTED POWER TOOLS
does the work of two spent on oversize machines.
You can get QUICK DELIVERY from Boice-Crane

Perform Production Miracles

with the BOICE-CRANE No. 2600 HELMET HEAD DRILL PRESS

Over 60 Models



One, two, three and four spindle types. High and slow speed; bench or floor type; slotted or trough table.

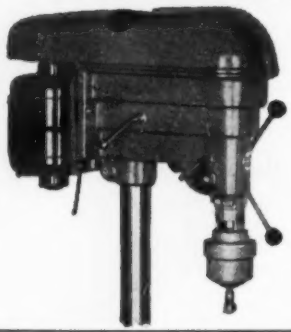
Perfectly balanced. Vibrationless.

Sealed against hazards common in other presses. The only drill press under $100.00 with an approved guard; the first guard that allows easy speed changing.

5 carefully predetermined efficient speeds, one for every operation. New self-centering 30-degree pressure angle 6-tooth involute spline. Spindle, quill, and spindle-pulley are held in permanent, perfect alignment.

The longer, larger diameter quill is held by three bearings, permitting long holes to be drilled more accurately than by other presses in same price range. The most durable, sensitive press in its class.

BOICE-CRANE TAPPING HEADS



for Helmet Head Drill Presses

Do light tapping better, cleaner, more economically. Operate at 3000 r.p.m. "IN"; faster than others, and 6000 r.p.m. "OUT". Taps enter every hole centrally and without slightest strain. 2 sizes.

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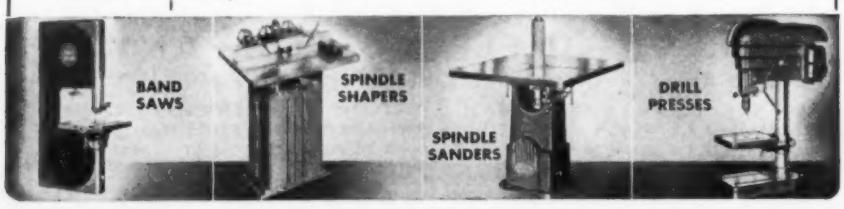


Challenge Portable ALL-STEEL STANDS

Built Specifically to Carry Challenge Surface Plates

● This wheel equipped, all-steel Stand has been developed to meet the growing need for flexibility in Plant Production lines. Made in three standard sizes (18"x24", 24"x24", 24"x36") this arc-welded all-steel Stand forms a solid base for Challenge Surface Plates and will accommodate many Plates other than Challenge.

AVAILABLE IN EITHER PORTABLE OR STATIONARY MODELS

The same models are also obtainable as stationary units (without wheels). Prompt shipment can be made. Write for prices.

LATEST CATALOG illustrates and describes complete line of Challenge Precision Equipment. Send for it today! 463

THE CHALLENGE MACHINERY CO.
1917 50th ANNIVERSARY 1943
GRAND HAVEN, MICH., U.S.A.

Mile-a-Minute Speed

pounded life out of belts in 2 months—

but not Any More!

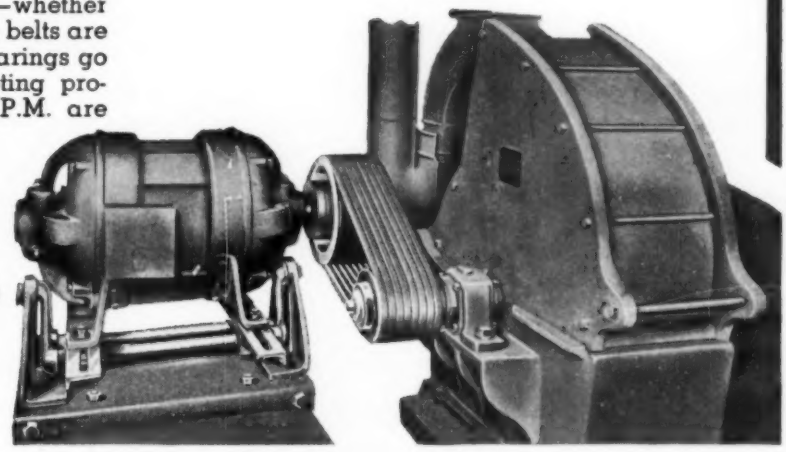
Mile-a-minute belt speed, plus a heavy starting load—requiring extra high belt tension—was causing a flour mill operator plenty of trouble. Belts wore out in two months on his hammermill drive. Cost of replacements were excessive. Shutdowns were a headache. Something had to be done.

An *American Econ-o-matic Drive* solved the problem. Belts now take starting load easily and give normal service life. In less than a year, the drive paid for itself by savings through lengthened belt life and reduced maintenance attention.

Improper belt tension causes many costly production and maintenance problems—whether starting loads are heavy or light. When belts are too tight they wear out rapidly and bearings go bad—forcing shutdowns and interrupting production. When belts are too loose, R.P.M. are lost and machine output is reduced.

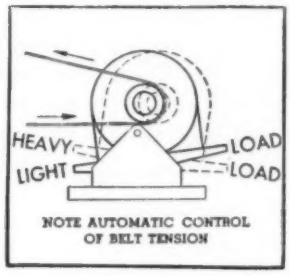
You overcome these problems when you change to American Econ-o-matic Drives. You increase machine output, double belt life, lengthen bearing life and reduce maintenance attention.

The Econ-o-matic Drive is an American Short-Center Drive—either Flat-belt or V-belt—with an Econ-o-matic Motor Base that gives you *automatic* belt tension control. No more worry about belts too tight or too loose. No lost R.P.M. No belt slip. No unnecessary "time outs" for frequent manual adjustments.



Get This New Econ-o-matic Handbook

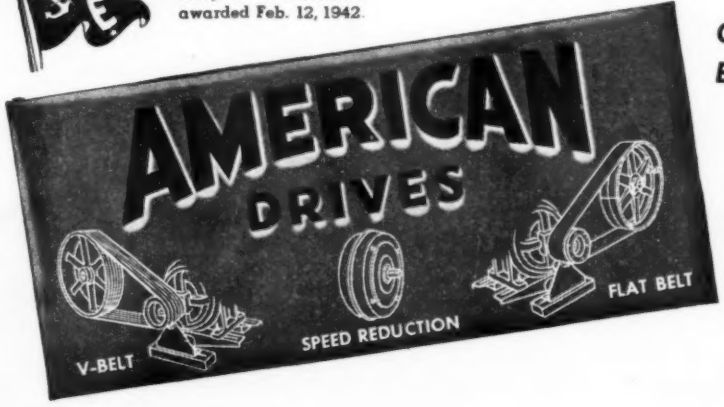
Here's a handbook of helpful information that shows you how to solve drive maintenance problems—how American Econ-o-matic Drives can help you increase machine output. It provides you with complete drive data. It shows how to select the right drive for your purpose. Send for your copy. Write now.



AMERICAN Econ-o-matic DRIVE

. . . the load governs belt tension. Here is the heart of the Econ-o-matic Drive . . . the American Econ-o-matic Motor Base. It *automatically* and *instantly* matches belt tension to each variation in the load on the motor. When load is heavy, belt is automatically tightened. When load is light, belt is automatically loosened. There is never more tension on the belt than the load requires. No slide rails or idlers to adjust. It's automatic!

Navy "E" for excellence awarded Feb. 12, 1942.

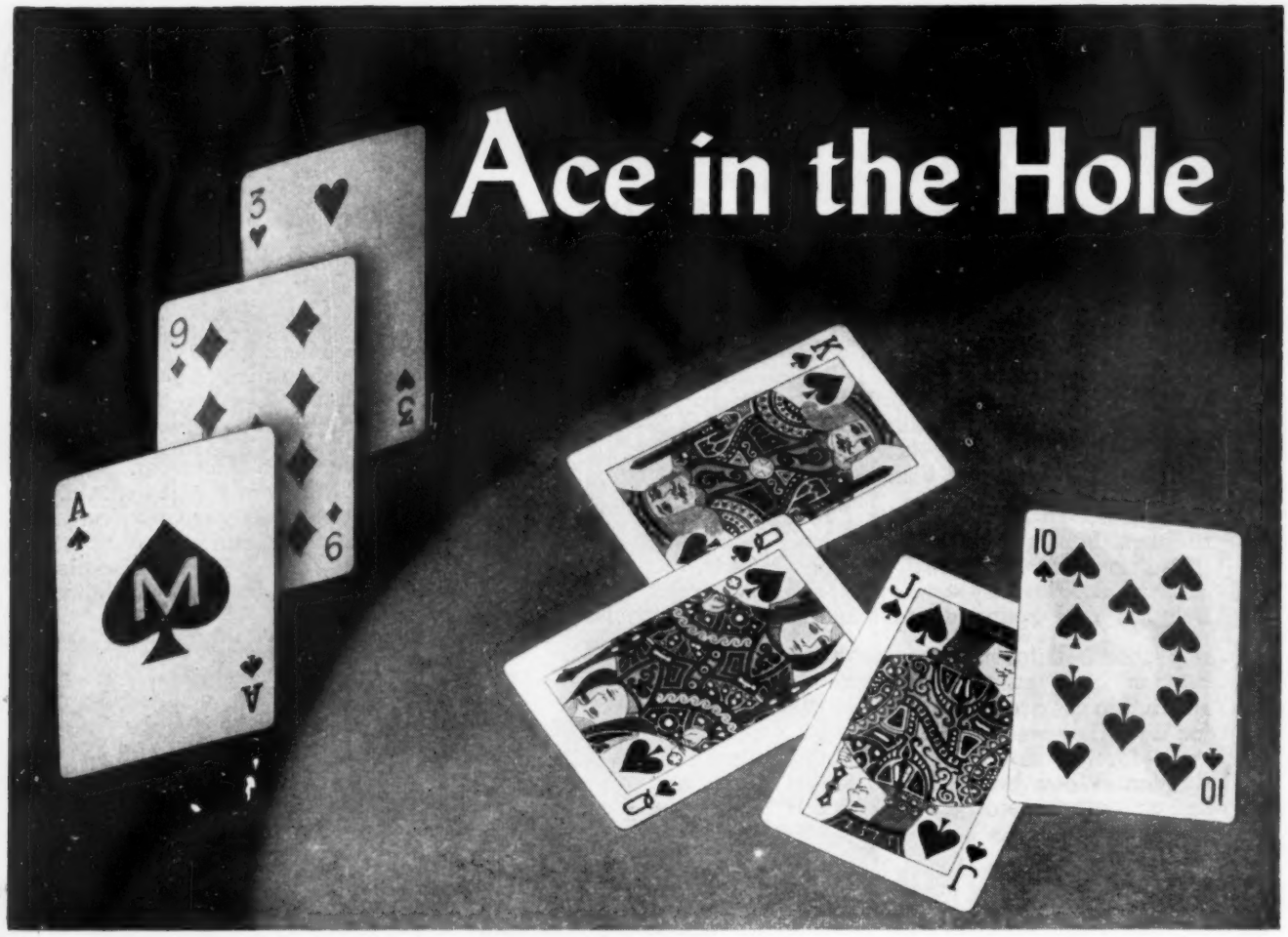


Check these advantages of the AMERICAN Econ-o-matic DRIVE (Short-center Flat- or V-belt Type)

- ★ *Longer life for belts and bearings*
- ★ *No belt slip—no lost R.P.M.*
- ★ *Maintenance man-hours greatly reduced*
- ★ *Smooth, cushioned starting*
- ★ *Increased machine output*
- ★ *Substantial power savings*

The American Pulley Company

4202 WISSAHICKON AVE., PHILADELPHIA, PA.



The player with an ace in the hole—an ace that will complete a Royal Flush—takes the money.

The plant that can market a better product, and sell it for less, will take more than its share of the post-war business in its field.

Morse Chain Drives, we know from experience, can help many a manufacturer with a power transmission problem to better both the quality and quantity of his post-war production—and enable him to sell at lower cost. For this reason, Morse Drives at work in your plant or in the machines you build can be, potentially, an ace in the hole that will help you beat tough competition.

If you are looking ahead, planning a post-war program—make it a point to talk to your nearest Morse man. He can give you facts and figures, and show you why Morse Drives merit your serious consideration, regardless of the type drives you now employ.

Right now, Morse, like most manufacturers, is all out on war work . . . and eager to help others producing the weapons of war. Tomorrow, when peace comes, Morse plans to serve you better . . . to apply well-learned lessons that will help you, and Morse, to grow.

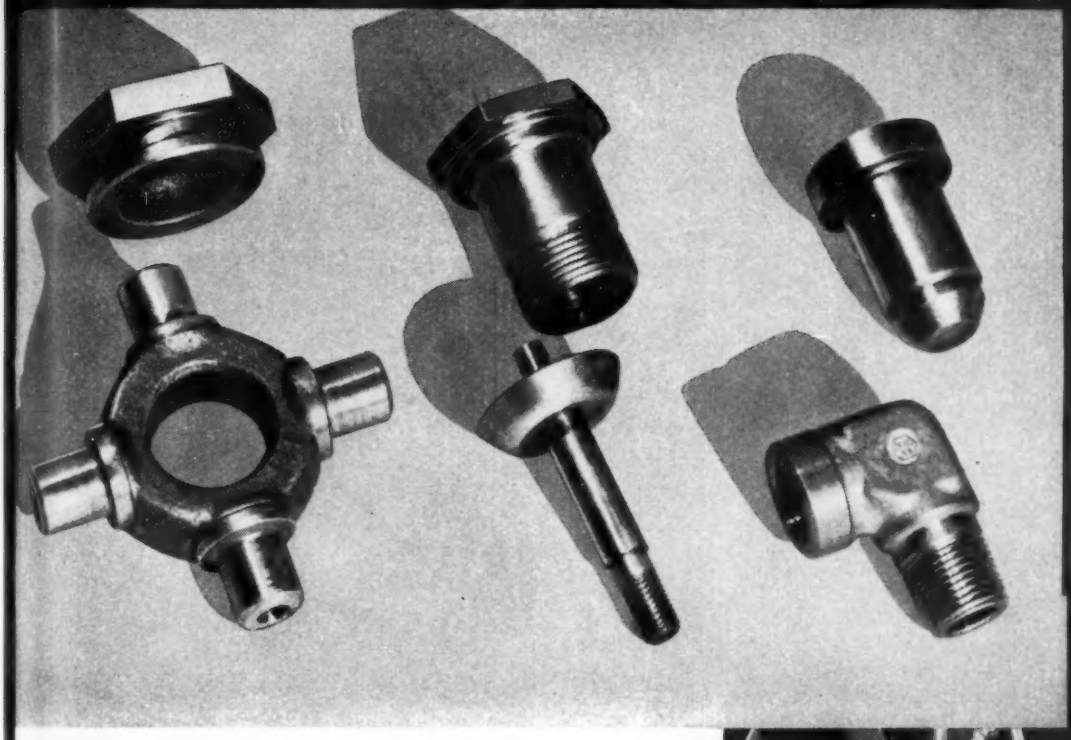
Pioneering—Morse Rocker Joint Super Drives are opening up new fields beyond present power transmission ranges. 3/16" pitch Morse Drives are being used in transmitting no-load timing motions, other Morse Drives are employed in precision machining operations—because they can't slip. Daily, Morse engineers are finding better answers to power transmission problems.

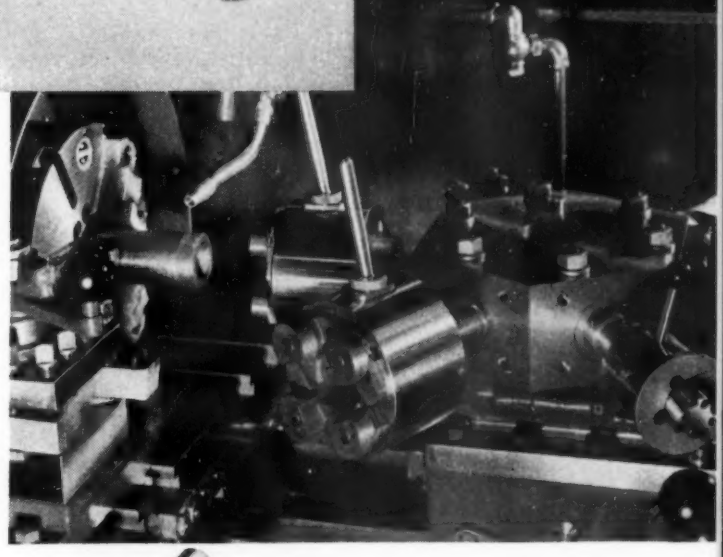
SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA, N. Y. DETROIT, MICH. DIVISION BORG-WARNER CORP.

How to SPEED UP
END FORMING AND END TURNING





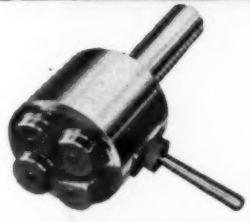
FOUR cutting edges, in one automatic head, do *three* times the work of any single point tool.

For diametric adjustments, you don't fuss with separate cutters for different diameters—one adjustment of circular mills brings them all to size—right on the machine.

That's the principle behind Namco high production and high precision Namco self-opening die heads with multiple circular hollow milling cutters. Thousands, or hundreds of thousands, of identical pieces are produced with positively NO variation in dimensions.

Namco heads are double-duty tools; circular ground thread chasers are interchangeable with hollow milling cutters.

Here is the modern way to cut costs without loss of precision. Catalog D-42 gives complete information.



Hollow milling, threading and tapping with Namco die heads and collapsible taps.

THE NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ACME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND TAPS • THE CHRONOLOG • LIMIT AND CONTROL STATION SWITCHES • SOLENOIDS • CENTRIFUGES • CONTRACT MANUFACTURING

The War...And You!

Friend—don't think this war doesn't affect you. It does. It's pushing the world twenty years ahead of time; stimulating the development of devices you may now be making or using. After the war, the average American's life is destined to be fuller, more exciting, more comfortable due to these new products. And just as Weatherhead has helped build the nation's automobiles, airplanes and refrigerators in the past, peace will find us prepared to join you in building these established products as well as the many new ones certain to come out of the war.

Look Ahead with

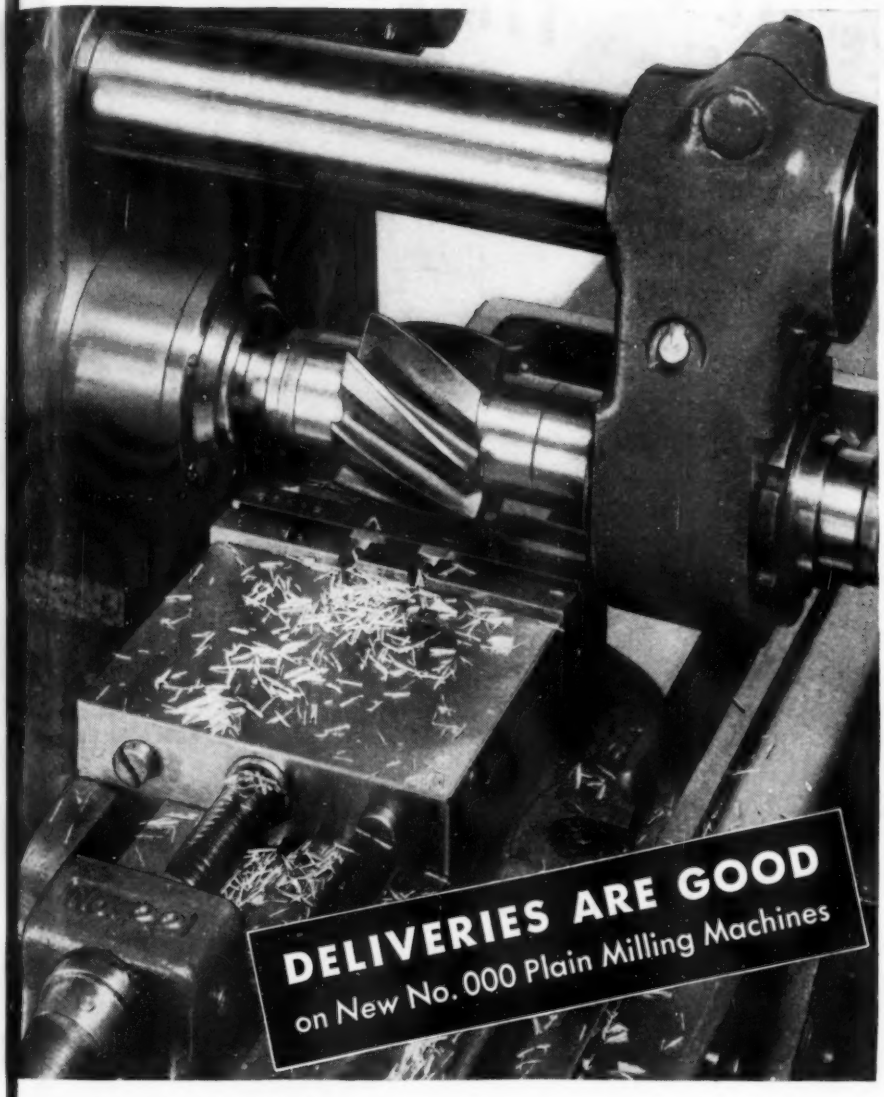
Weatherhead

THE WEATHERHEAD CO., CLEVELAND, OHIO
Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Plants: Cleveland, Columbia City, Ind., Los Angeles
Canada—St. Thomas, Ontario

Acme for Action
ARMY E NAVY
Action, trigger-quick action, sets the enemy on the run as our boys land on foreign shores.
And quick action on the home front in producing needed equipment will help *keep* the enemy on the run.
So here at Acme we constantly strive to break production records in supplying patterns, dies, heat-treated aluminum castings, and specialized tools needed by war plants to speed production of war materials.
Acme service is complete, including engineering counsel when desired. Submit your requirements without obligation.
ACME PATTERN & TOOL COMPANY, Inc.
DAYTON, OHIO
Heat-Treated Aluminum Castings — Patterns — Tools — Tool Designing — Production Processing
For VICTORY buy WAR BONDS and STAMPS

KEEP NON-CUTTING TIME AT A MINIMUM ON YOUR Nº 000 PLAIN MILLING MACHINE



Careful set-up minimizes length of operating cycle

—a waste of even two or three seconds represents a considerable percentage increase on a short cut

The No. 000's accuracy of feed engagement and table reversal allows close setting—and the 3/8" minimum length of cutting feed permits milling short cuts ***efficiently***.

On any job —

1—Locate the work so cut will be completed just at point of table reversal

2—Set the table dog to bring the work up close to the cutter at fast travel

We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

Make **full** use of the production possibilities of the No. 000 Plain Milling Machine for the rapid milling of small parts on a wide variety of materials.

BROWN & SHARPE

BELIEVE IT OR NOT, GENTLEMEN WE CAN MAKE ALL DELIVERIES ON TIME!

IT CERTAINLY PAYS TO INSTALL

TURNER UNI-DRIVE
Motorizes Machine Tools

These Features are Responsible:

- **No belts to shift—Drives to large step of cone at all speeds**
- **Eliminates overhead line and counter shafts**
- **All advantages of geared head with belt drive smoothness**

The high-speed, volume-production methods of wartime call for modern machines, modern methods. More speed ... greater production ... you must have them to keep apace! Enlist the aid of TURNER UNI-DRIVES. They'll increase production like an extra shift ... save time ... speed up work ... keep down power costs. They're doing it in scores of shops and plants. They'll do it in yours. TURNER UNI-DRIVE is the *successful* one motor drive.

Easily and quickly installed. They do away with overhead counter shafts ... no belts to shift. Increase the efficiency of machine and operator. One trial will thoroughly convince you.

Right now ... today ... investigate TURNER UNI-DRIVE. See your dealer, or write or wire us for full information.

NOW AT WORK FOR VICTORY ★★★

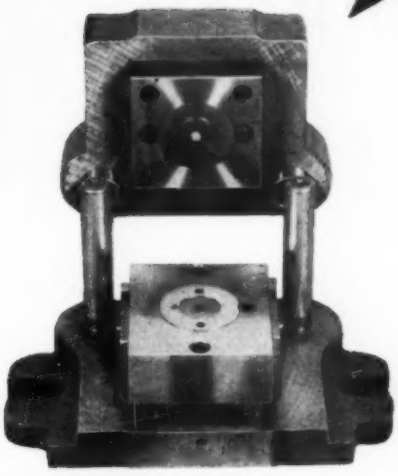
IT DOES THE JOB on Lathes, Shapers, Milling Machines, Turret Lathes, Radial Drills, Boring Mills, Hobbing Machines and various machine tools. Also for Browne & Sharpe and Cleveland Automatic Screw Machines.

THE TURNER UNI-DRIVE COMPANY
(Sales Division: Turner Machinery Co.)
3416 Terrace Street, Kansas City, Mo.

PRODUCING MACHINE TOOL DRIVES • ORDNANCE TOOLS • AIRCRAFT FITTINGS

HOVIS
UNIVERSAL MASTER WASHER DIES

DIE COMPLETE
Ready for Interchangeable Parts



A COMPLETE SYSTEM FOR PRODUCING WASHERS

The Economical Method

THE big saving of materials and the wartime demand for speed have made Hovis Washer Dies a necessity. No longer is it necessary to go to the expense and waste of making a complete compound die for each new washer. The Hovis advanced method consists of a die complete in itself, ready to use. It is made on an all-steel precision standard die set, complete with stock gauges and stops. Once your nominal investment is made in Master Washer Dies to meet your requirements, five small interchangeable parts (see illustrations) are all that is necessary to purchase in order to make any size washer. All process engineering, tool designing, tool making and tool try out are eliminated. WRITE FOR NEW FOLDER.

5 PARTS EASILY REMOVABLE

ALL THE TOOLING REQUIRED
to make a new size washer

DETAIL NO. 6—Piercing Punch for inside diameter of washer.

DETAIL NO. 9—Button Die for blanking outside diameter of washer.

DETAIL NO. 13—Compound Blank, Punch and Pierce Die.

DETAIL NO. 8—Knockout, to remove washer from die.

DETAIL NO. 19—Stripper Bushing to strip stock from compound.

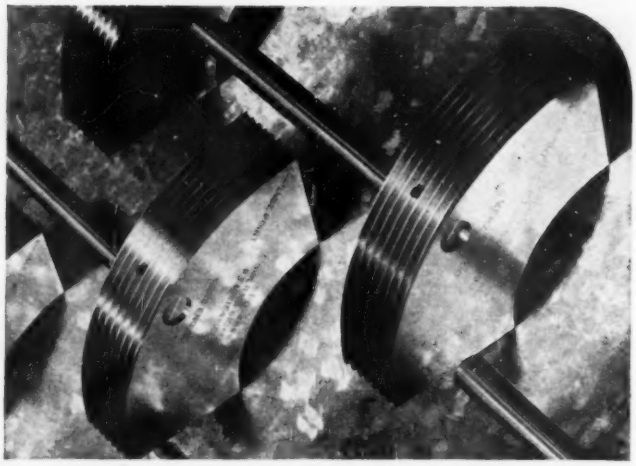
HOVIS SCREWLOCK COMPANY

8098 E. NINE MILE ROAD - VAN DYKE, MICHIGAN - Suburb of Detroit

DEPENDABLE SOURCE FOR

SPECIAL OR STANDARD GAGES

OF ALL TYPES



These special segment thread gages, are examples of the wide variety of thread, plug, and ring gages being regularly produced in our plant. Designed by our staff of engineers and manufactured to specified tolerances, they represent the highest skill and craftsmanship. The same high standards apply to special tools, fixtures, machines and parts, produced singly or in volume on contract. Our facilities and equipment are equal to the finest in the country. Write for literature describing these special engineering and manufacturing services, and our line of standard gages, carried in stock for prompt shipment.

MERZ *Engineering Company*

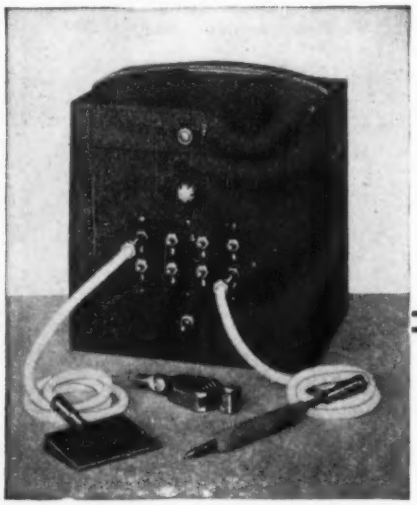
INDIANAPOLIS 7, INDIANA

Why Not Buy the Original Electric Etcher?

MARK IRON *and* **STEEL**

THE Etchograph WAY

3000 IN USE



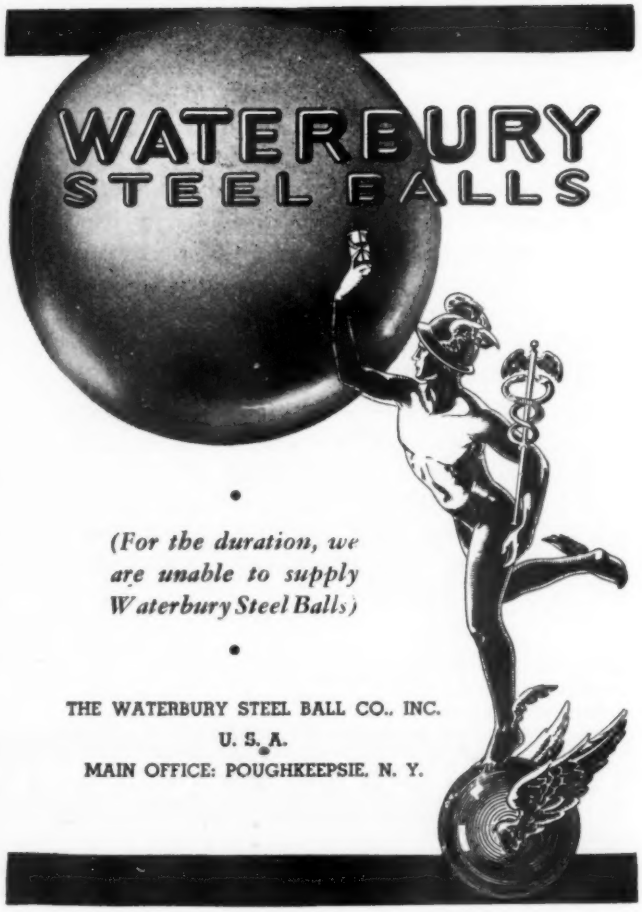
Mark parts in process, tools, dies, gages and fixtures of any ferrous metals including the hardest alloys and carbides—quickly—plainly.
Three sizes to meet all requirements.

Write for circular and prices

BREWSTER-SQUIRES & CO.

Hudson Terminal Bldg. New York, N. Y.

WATERBURY STEEL BALLS



(For the duration, we are unable to supply Waterbury Steel Balls)

THE WATERBURY STEEL BALL CO., INC.
U. S. A.
MAIN OFFICE: POUGHKEEPSIE, N. Y.

Take a Look at TOMORROW—*Today!*

Mr. Now: Dried out, *soaked, and baked,* eh! So that's why Century Motors stand up!
Mr. Postwar: I'll remember that — it's another reason why I shall specify *Century* Motors.

Century Form J Motor

The Protection of
CENTURY INSULATION
Assures Continuous Motor Performance Under the Toughest Conditions

By the use of slow-moving conveyors and automatically-controlled ovens, the completed stator and winding of Century Motors is dehydrated, and then is submerged in and passes through a tank filled with Century "Clingto" insulating varnish, and then baked. This process is repeated as necessary to preserve and seal the winding into a homogeneous mass.

This is followed by a final coat of Century "Protecto" insulation compound which places a heavy exterior protecting armor over the entire winding.

Century slot insulation is built up with fibre board for mechanical strength and varnished cloth for dielectric strength.

The entire Century insulation process produces a winding that is highly resistant to moisture, to tropical climatic conditions, to mild acid and alkali fumes, and to the effect of magnetic vibration and the mechanical impact of particles carried by the cooling air.

Such insulation material and treatment is absolutely necessary for motor protection for long operating life.

Your nearest Century Application and Service engineer will gladly give you full details of all the advantages of Century Motors—show you why thousands of plants rely on Century for continuous, all-out production.

Century MOTORS
1/6 to 600 horsepower

CENTURY ELECTRIC CO.
1806 Pine Street
St. Louis, Missouri
Offices and Stock Points in Principal Cities

307

One of the Largest EXCLUSIVE Motor and Generator Manufacturers in the World.

DON'T WAIT FOR TURRET LATHES

Convert any engine lathe into a turret lathe in 15 seconds with JEFFERSON TURRET ATTACHMENTS. To fit bench lathes and lathes up to 24" swing.

● This new modern TOOL-POST TURRET, (below, right), made in 2 sizes, designed to increase production on engine lathes. Easily mounted on cross slide or compound rest. Has capacity of 4 standard tool holders which are easily inserted and rigidly held.

6 Days Delivery

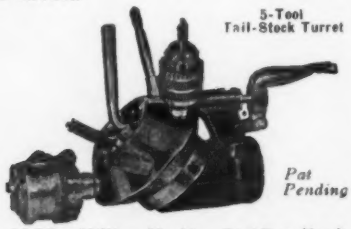
● Then there's the completely modernized 5-tool TAIL-STOCK TURRET (below, right), made in 4 sizes to fit small bench lathes and lathes up to 24" swing. Also the adjustable PULL-FEED LEVER. Jefferson Turrets are real production tools—substantial, rigid, accurate. They must not be confused with the small make-shift gadgets now on the market.

Pat Pending

4-Tool Tool-Post Turret

The Jefferson Bull-Dog Precision Milling Machine. Obtainable Power or Hand Feed.

5-Tool Tail-Stock Turret



Pat Pending

● ALSO—*Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.*

JEFFERSON MACHINE TOOL CO.
SO. SWEENEY, CUTTER & FOURTH STS. CINCINNATI, OHIO

REID All Electric Automatic Feed Surface Grinder No. 2B

Equipped with Motorized Spindle

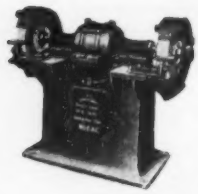
A Proven Product for Over a Quarter Century with Thousands in Use Daily

Send for Descriptive Literature
EXCELLENT DELIVERIES

Exclusive Selling Agents
H. LEACH MACHINERY CO.
387 CHARLES ST. PROVIDENCE, R. I.
Agents in all Principal Cities Throughout the World

BRIDGEPORT FLOOR GRINDERS

save time and money in snagging and rough grinding



Put your hard jobs on "BRIDGEPORT" Heavy Duty Grinders and cut your costs.

Simple in design, rugged, durable and amply powered for all kinds of tough service. They will stand up under abuse, hard work and continuous off-hand grinding.

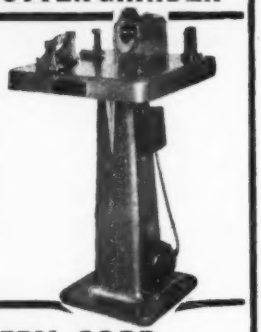
Spindles are of large diameter high carbon steel and run on deep groove ball bearings. Spindle bearings are oil lubricated with large sumps in each housing.

Made in sizes from 3½ to 15 H.P. Write for complete detailed specifications.

The BRIDGEPORT SAFETY EMERY WHEEL CO. inc.
1286 W. BROAD STREET BRIDGEPORT, CONNECTICUT

The BARNES PRECISION CUTTER GRINDER

Grinds any profile desired with SPEED and ACCURACY



Regardless of how complicated or irregular the gang or cutter, the "Barnes" will grind it to the exact form desired with an accuracy that leaves nothing to be desired.

The speed and savings assured by this machine are available without any need to change existing cutter equipment. With the Barnes Precision Cutter Grinder the use of profile ground formed cutters is made possible thereby assuring the production of the high quality and quantity of work for which this type of cutter is so well known.

Write for Descriptive Circular

GENERAL MACHINERY CORP.
140 Federal St. Boston, Mass.

CINCINNATI LATHES
Accurate in Every Detail

Gears—precision cut, tempered and ground . . . Spindle—mounted on Roller Bearings to resist any combination of thrusts . . . Bed—extra heavy in construction. . . . Ways and carriage hand scraped to a precision bearing. These features of Cincinnati Lathes add up to accuracy in every detail that insures precision results on every job. Write for complete specifications on 14" to 30" sizes to produce your work always most economically.

THE CINCINNATI LATHE & TOOL CO.
Rogers Road, Oakley SPECIALISTS SINCE 1906 Cincinnati, Ohio

In the tight spots it's a STAR

ELECTRO LIFT'S Type B Monorail Hoist is designed to operate with extremely limited headroom. At the same time, it must provide powerful lifting capacity at high speed. A "tight spot" for the motor? No doubt about it. But Star, through its unique welding construction, solves the problem completely without special molds or castings. Result: "Tailored" 4 HP. motors complete with magnetic brake supplied as easily as any standard model. (The trolley motor is a STAR too—1 HP. in standard design.) Just another example of Star performance which combines the flexibility of specialized application and specialized engineering with the obvious advantage of standardized design.

Star Electric Motor Company
Bloomfield, New Jersey

For 33 years Star Motors have provided a complete line of standard as well as specialized motors—in sizes from ½ to 200 HP. Today they are providing dependable power for hoisting and many other applications. Write us about your requirements.

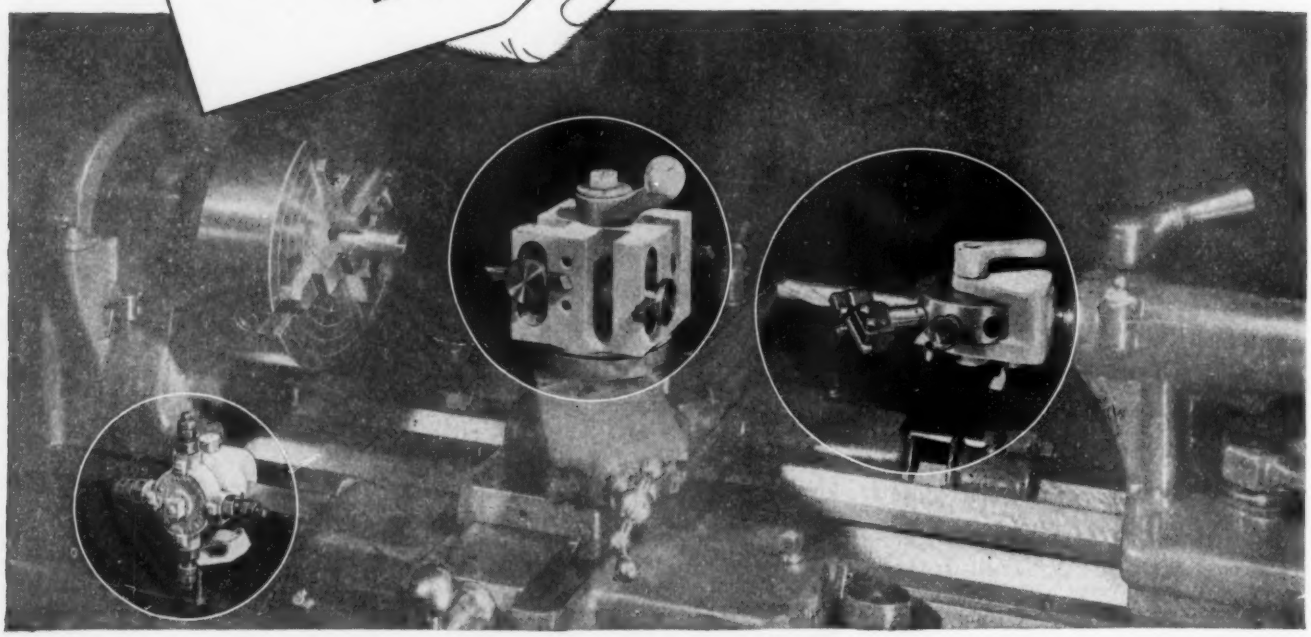
ARMY E NAVY

POWER PACKAGED AS YOU NEED IT

STAR MOTORS

Make Your Present Lathe A 4-Way Turret

CLIP COSTS
SPEED PRODUCTION



➡ SPECIALTIES CROSS-SLIDE TURRET enables multiple machining operations on the same lathe. You get 4 working positions, no time lost in changing tools. Tie up one lathe instead of four. Merely flip turret, clockwise or counterclockwise, from one index position to another. A clamplever locks it solidly. Tool bits can be rotated to any angle to get the desired clearance angles on tools.

➡ SPECIALTIES TAILSTOCK TURRET quickly converts engine lathe into 4-way turret lathe for end work. Cuts machine costs, gives 4 different operations with one tool. Now you do tapping, boring, finishing, etc. with the same tool.

➡ SPECIALTIES LATHE STOP saves valuable time. You measure only once for each operation. Spring pin automatically locks spacer arm in position to insure accuracy and efficiency.

Here is an ideal production team for turning out more vital war material in less time, with greater efficiency. Simply use the coupon for full details on SPECIALTIES lathe accessories.

SPECIALTIES Manufacturing Co., Inc.
42 Farrand Street, Bloomfield, N. J.

Please send me full information on SPECIALTIES lathe accessories.

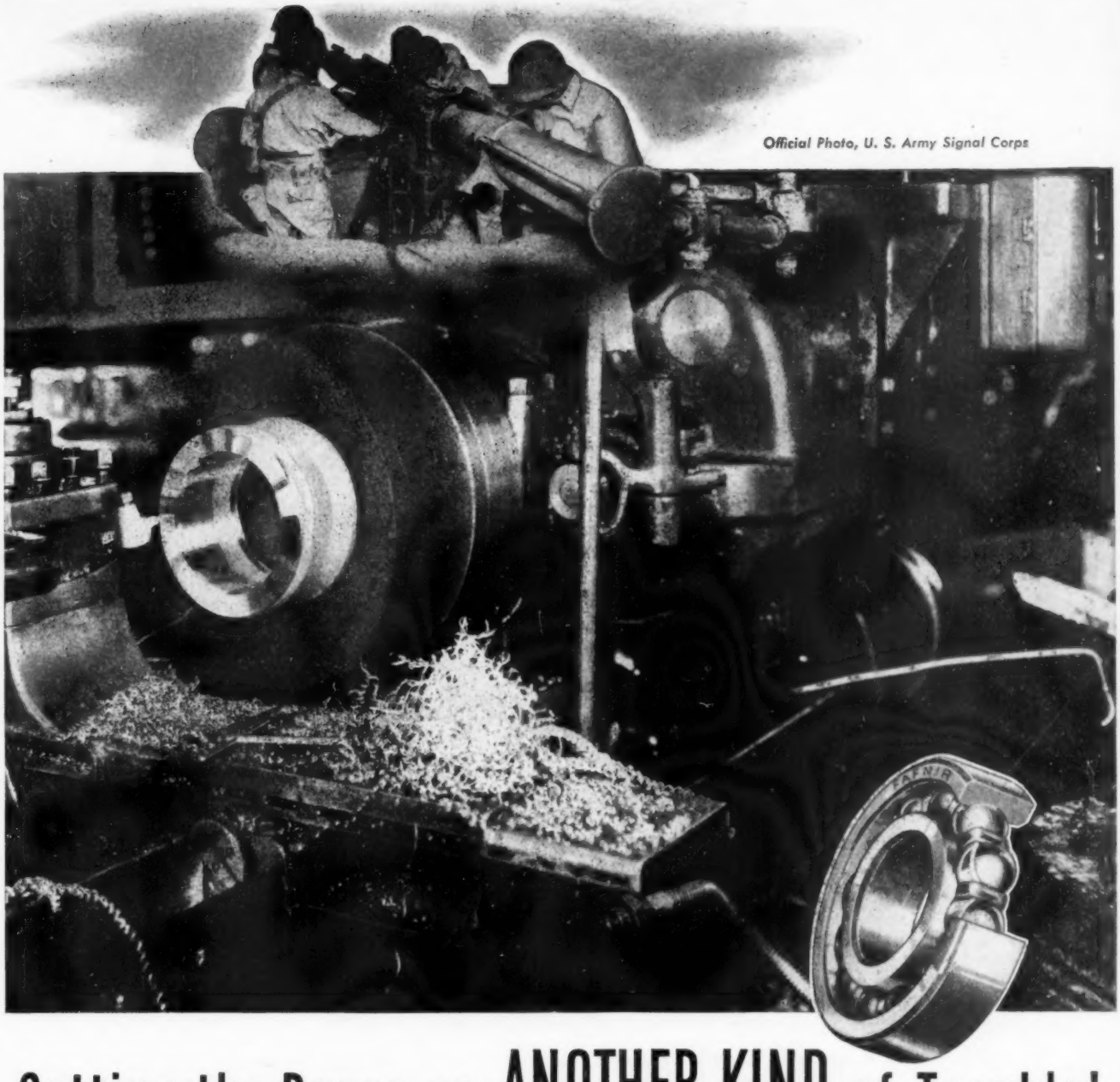
Name_____

Company_____

Address_____

City_____ State_____

SPECIALTIES
MANUFACTURING COMPANY, Inc.



Official Photo, U. S. Army Signal Corps

Getting the Range on ANOTHER KIND of Trouble!

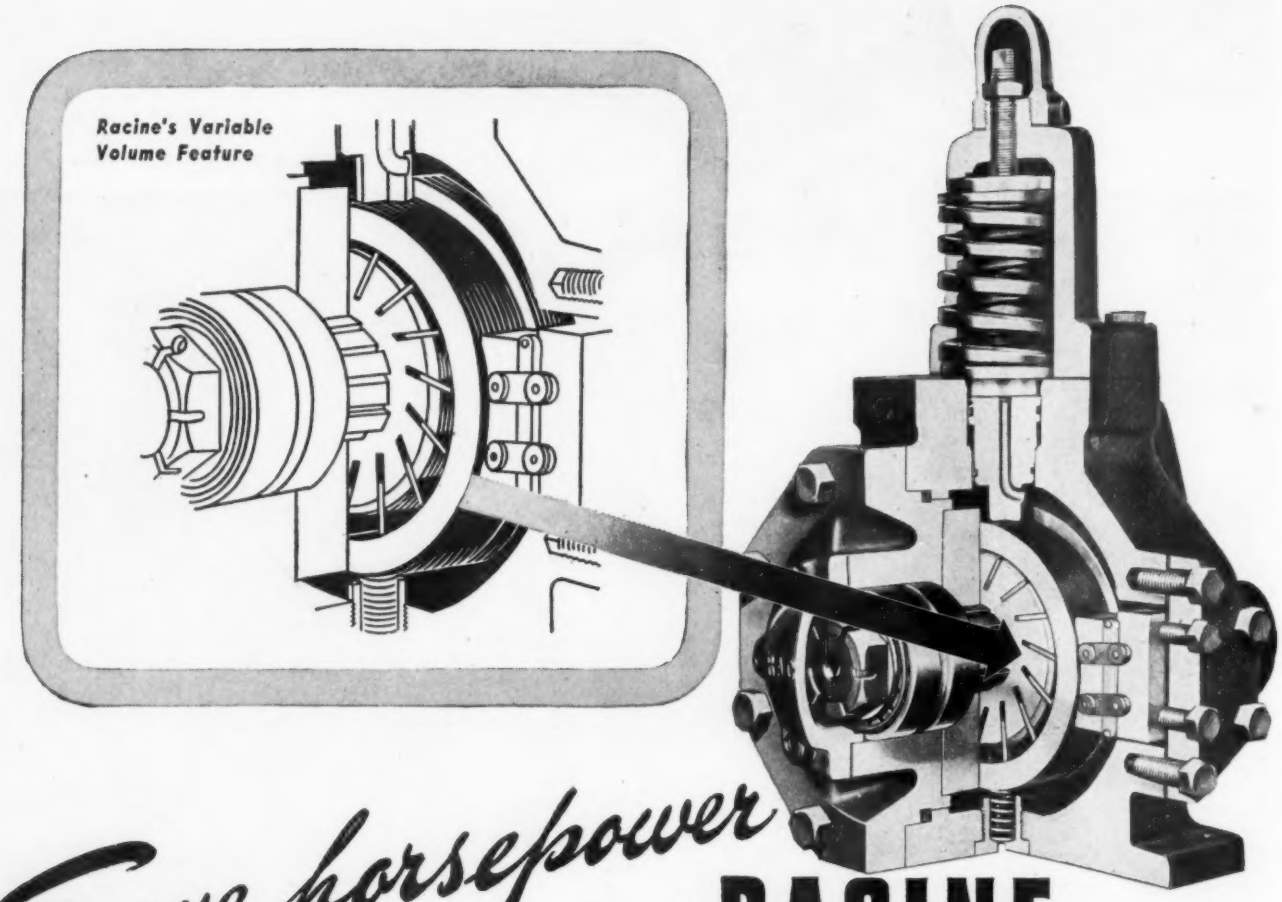
A slight chatter in a machine tool in a Michigan factory may cause a machine gun to jam in Africa. An important piece of equipment forced out of action in Delaware may mean that a Marine in New Guinea runs out of ammunition. Discouraging the relentless attack of *trouble* is a matter of most serious concern throughout our great war industry, right now.

This need to eliminate troubles, slow-downs and breakdowns in these hard working machines is magnifying the importance of Ball Bearings! Friction-free Fafnir Ball Bearings were made to discourage these casualties. Their rugged stamina and Balanced Design . . . larger balls and deeper races . . . keep them on the job on machines whose work-day is 24 hours *every day*. Their in-built precision defeats chatter and deflections on machines that must hold tolerances on the button . . . month after month. The Fafnir Bearing Company, New Britain, Conn.

ARMY (E) NAVY

FAFNIR

BALL BEARINGS



Save horsepower with RACINE

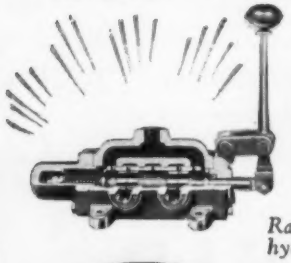
oil hydraulic "Variable Volume" pumps

A MODERN SOURCE OF HYDRAULIC FORCE

Racine's "Variable Volume" design makes the most efficient use of your power. It pumps *only* the minimum amount of oil to do the job—no wasted power or oil pressure—no need for by-pass and relief valves—and it reduces oil heating.

The delivery of oil is varied by a simple pressure adjustment which changes the relative position of the pressure chamber ring to the rotor, so as to increase or decrease displacement. Racine Oil Hydraulic Pumps are made in three sizes — 0-12, 20 and 30 G.P.M. capacities. Pressures from 50 to 1000 pounds per sq. inch. They can be equipped with manual, electrical or mechanical controls for stationary or remote control.

RACINE Oil Hydraulic FOUR-WAY VALVES



Racine's "Balanced Piston—Sleeve Type" construction assures complete balancing of interior moving parts for smooth oil-cushioned operation. Piston lands are grooved to minimize hydraulic set. Racine complete line of Hydraulic Valves for pressure and flow control are available in ⅜" to 1½" standard pipe sizes with manual, solenoid, pilot and mechanically operated controls.

Racine engineers will be glad to help you with your hydraulic circuit work. Request complete data and prices. Write Dept. AM-P.

Investigate RACINE'S LINE OF HYDRAULIC METAL CUTTING MACHINES

The Production Saws of Modern Industry. War Production demands the fastest, most accurate metal cutting, and Racine Saws are doing that job today. Available in a wide range of designs and prices for general shop and modern production metal cutting work. Capacities 6" x 6" to 20" x 20".

RACINE — STANDARD FOR QUALITY AND PRECISION — RACINE TOOL and MACHINE CO.

RACINE TOOL and MACHINE COMPANY

Standard for Quality and Precision

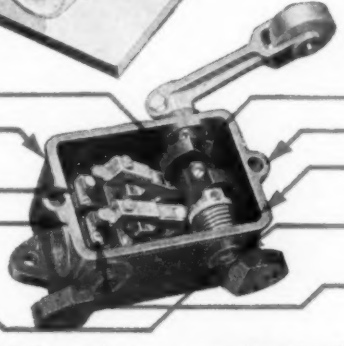
RACINE, WISCONSIN • U. S. A.

THEY TAKE ABUSE AND DELIVER SERVICE

"3C" Bulletin 102 Hatchway Limit Switches adapted for seafaring service . . . withstand a terrific damage test . . . A 400 pound weight is dropped 5 ft. (2000 ft. lbs.) upon a steel plate on which the adapted switch is mounted. No damage to the device results . . .

• *The Damage Test Type will be available only in the Post-War period.* « «

The entire moving Finger Assembly may be removed by simply removing one screw . . . Fingers are interchangeable with those used on Bul. 101 Master Switch; Bul. 102 Cam Limit Switch; Bul. 101 Foot Switch; and Bul. 102 Track Type Limit Switch.



STANDARD TYPE

- MOULDED BAKELITE CAMS
- CAST IRON HOUSING
- MOLDED BAKELITE STATIONARY CONTACT BASE
- GASKET AVAILABLE
- SHAFT END ENCLOSURE AVAILABLE

DAMAGE TEST TYPE

- LAMINATED BAKELITE CAMS
- CAST BRONZE HOUSING
- WATERTIGHT GASKET
- WATERTIGHT SHAFT END ENCLOSURE
- LAMINATED BAKELITE STATIONARY CONTACT BASE

Note above the few changes in the Standard Type that make the Damage Test Type deliver service—proof that "3C" Bulletin 102 Standard Hatchway Limit switches are electrically and mechanically right . . . Thousands of "3C" Standard Hatchway switches in heavy duty industrial use are further proof of their serviceability.

CONTINUE TO ROLL WITH CLARK CONTROL

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, 10, OHIO

Again Apex helps the users of Phillips Screws!

APEX announces a series of bit holders that revolutionizes the use of Power Bits and Hand Drivers for Phillips Recessed Head Screws. Here's what they do:

One Save you money after original installation of holders is made because they eliminate necessity of carrying so many different sizes of screw driver bits. Only item necessary to carry in stock is the insert tips. One range of inserts fits various sizes of holders.

Two Save vitally needed critical steel and release it for other war time users.

Three Increase bit life due to the float between insert and holder, allowing for easier direct alignment with recess in screw.

Four Decrease handling cost of screw driver bits because it is no longer necessary to return screw drivers for reconditioning as cost of inserts is approximately that of the reconditioning charge.

Send for Bulletin No. 102 giving complete details.

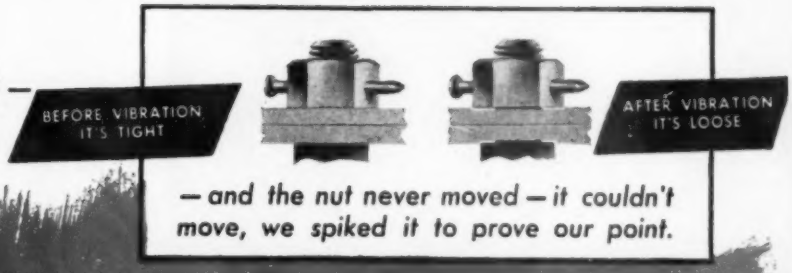
APEX

THE APEX MACHINE & TOOL COMPANY • DAYTON, OHIO

Manufacturers of Power Bits for Phillips, Slotted Head and Clutch Head Screws; and Hand Tools for Phillips and Clutch Head Screws.

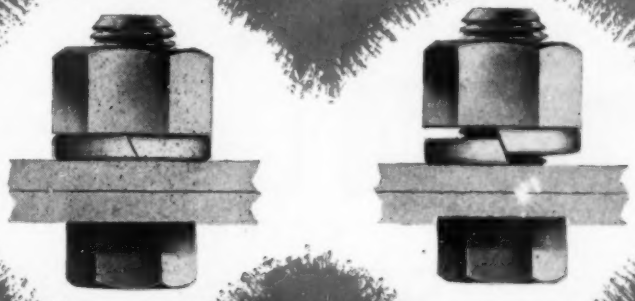
YOU CAN'T GO ALL THE WAY ON HALF-WAY MEASURES

Here's a halfway job – with a fixed nut alone.



– and the nut never moved – it couldn't move, we spiked it to prove our point.

HERE'S A WHOLE WAY JOB, ANY NUT PLUS A KANTLINK SPRING WASHER



BEFORE VIBRATION—IT'S TIGHT

AFTER VIBRATION—IT'S STILL TIGHT

— still the nut never moved, – it could not. The spring washer held it tight by expanding as other parts wore, for all parts do wear under vibration and stress.

Only a strong helical **spring** washer can expand and compensate for inevitable wear, bolt stretch, abrasion, lapping, etc. Kantlinks prevent dangerous loosening of all bolted assemblies.

There is **no substitute** as economical. No fixed nut nor any short range multi-toothed washer can possibly equal the great holding power of a **long range live spring** – a big helical spring such as Kantlink.

Let us send you samples – send details of your application. Test and compare them on the same job with **any** type of nut, or with **any other type** of washer. Kantlinks can't lose a real test. Try them for efficiency, economy and real safety.

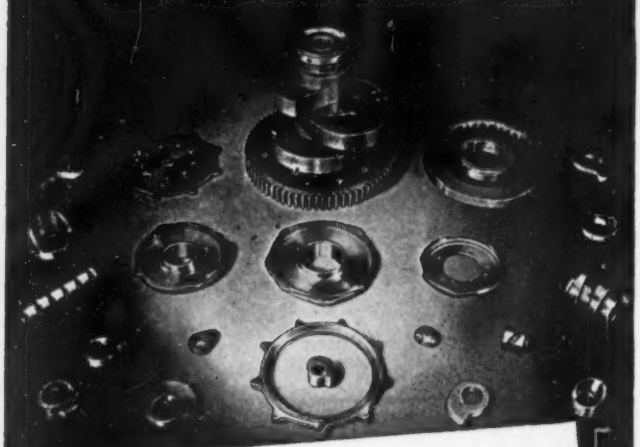
Write today for descriptive folder.

KANTLINK
TRADE MARK

the long-range Spring Washer

THE NATIONAL LOCK WASHER COMPANY
NEWARK, N. J., U. S. A.

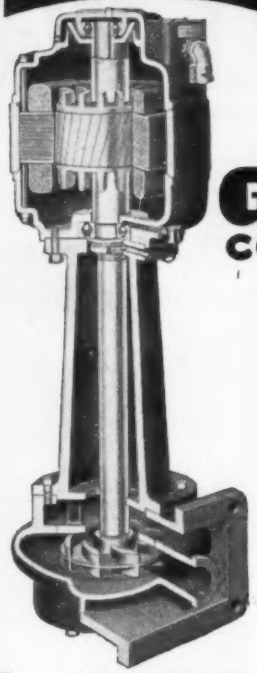
CAMS



LET the largest, most completely equipped cam milling plant in the mid-west handle your cam problems. All sizes of drum, face, groove or other styles of cams cut to order in quantities of one or one thousand. Send specifications or blueprints for a quotation on your requirements.

KUX MACHINE COMPANY
3930-44 W. HARRISON, ST. CHICAGO, ILL.

When Cutters Meet RAW STOCK



GUSHER
COOLANT PUMPS
ARE ON THE JOB

The copious, dependable flow of coolant supplied by Gusher Coolant Pumps helps your skilled workmen and machines produce *more*. Reduces wear and tear on tools.

No metal-to-metal contact . . . not injured by small chips and grit . . . simple in design, Gusher Coolant Pumps are the favorites of plant superintendents and workmen.

There's a Gusher to meet your requirements. Write

THE RUTHMAN MACHINERY CO.
1809 Reading Road Cincinnati, Ohio
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

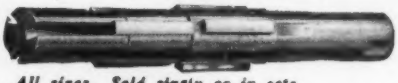
Don't Overlook This Possibility for Increased Production

★ ★ ★

Equip your shop with these economy tools for holding work while being machined. Hardened tool steel—precision ground.

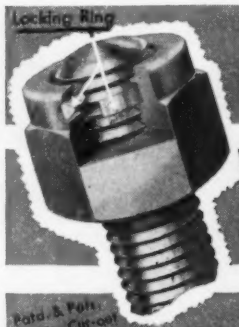
NICHOLSON Expanding MANDRELS

Save Time
Improve Shop Efficiency



Two types. All sizes. Sold singly or in sets. Prompt delivery. Bulletin No. 741.

W. H. NICHOLSON & CO.
114 OREGON ST., WILKES-BARRE, PA.
Other Products: Arbor Presses—Control Valves—Steam Traps—Etc.



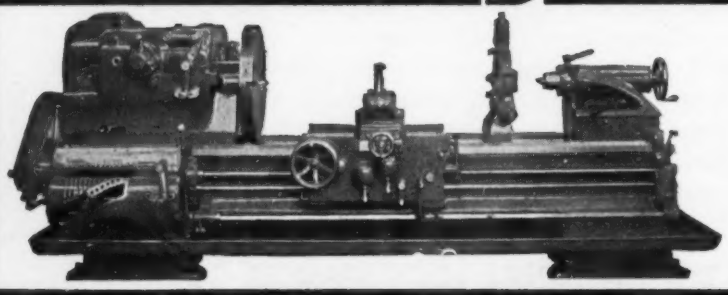
UNSHAKO
Reg. U. S. Pat. Off.

SELF-LOCKING NUT
HOLDS TIGHT

Patd. & Pats. Pendg. Cut-out section showing locking ring in place.

STANDARD PRESSED STEEL CO.
BOX 4 JENKINTOWN, PENNA.

SPRINGFIELD GEARED HEAD LATHES



for peacetime or war production!

A lathe purchased now, for round-the-clock war production, must still meet peacetime requirements. Therefore, specify SPRINGFIELD lathes—flexible, efficient, ideal for emergency or normal production. SPRINGFIELD lathes are built in sizes from 14" to 30". Write for descriptive bulletins, prices, deliveries, etc.

The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.

"THE TAP-OF-THE-YEAR"

From a highly specialized plant in Greenfield, Massachusetts have been shipped hundreds of thousands of taps since Pearl Harbor. On each has been stamped the maker's name . . . "Threadwell". These high speed taps have gone onto hundreds of production lines that had never heard of "Threadwell" Taps before the war. And from these users of Threadwell Taps come words of appreciation . . . for their stamina, accuracy and performance . . . for their rust-proof finish . . . for their "dot" system of easy identification . . . for the modern transparent plastic containers in which ground thread taps are shipped . . . and for the cooperation from Threadwell distributors in expediting orders and shipments. In the minds of many such users . . . the Threadwell Tap is indeed the "Tap-of-the-Year".

YOU CAN TELL BY THE DOT!

You can tell a Threadwell High Speed Tap by the dot on the shank. A red dot for cut thread, white dot for commercial ground and a blue dot for a precision ground tap.

EXPORT STOCKING DISTRIBUTORS
CANADA: Bridge Machinery Co., Montreal
ENGLAND: Saytar Ltd., London

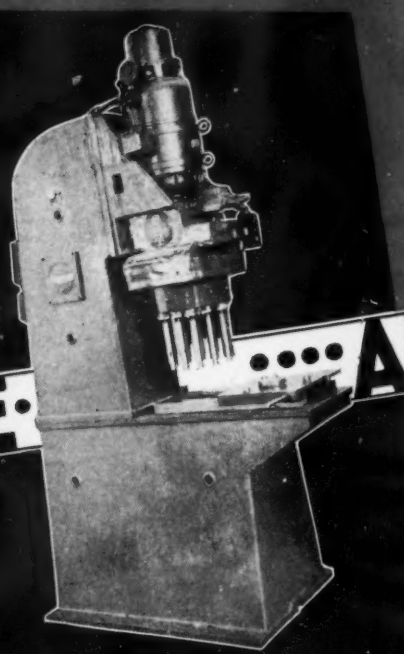
Threadwell
"TAPS OF DISTINCTION"

THREADWELL TAP & DIE CO., GREENFIELD, MASS., U. S. A., FOUNDED 1902

ARMY E NAVY

BAUSH

50 YEARS "ON THE ... ALERT"



The conflict raging today is not the first through which Baush has passed and made worthwhile contributions. Back in the nineties, Baush machine tools were serving metal working plants turning out munitions for the Spanish-American War. Even prior to that time the name "Baush" was familiar in the machine tool industry.

As a result of its fifty years of specialized experience and pioneering* Baush has contributed many features in design and construction which assure greater speed, accuracy and convenience in war production.

BAUSH

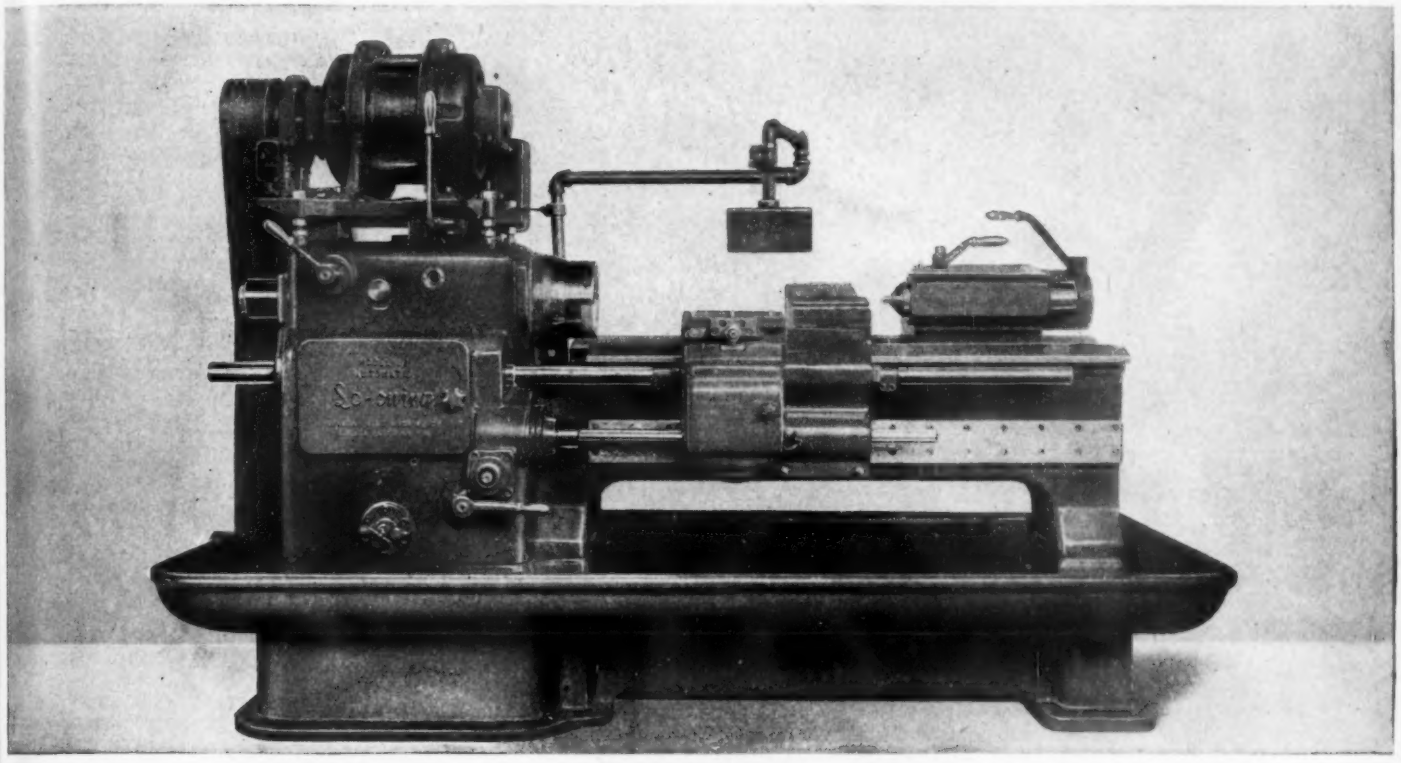
MACHINE TOOL CO.

SPRINGFIELD, MASS.
DETROIT, MICH.

Baush has a record of 50 years in pioneering and building Multiple Spindle Drilling, Tapping and Boring Machines and special equipment.

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE *Lo-swing* PEOPLE"** SENECA FALLS, NEW YORK



MODEL LR *Lo-swing* LATHES SOLVE PROBLEM OF TURNING ELECTRIC MOTOR SHAFTS

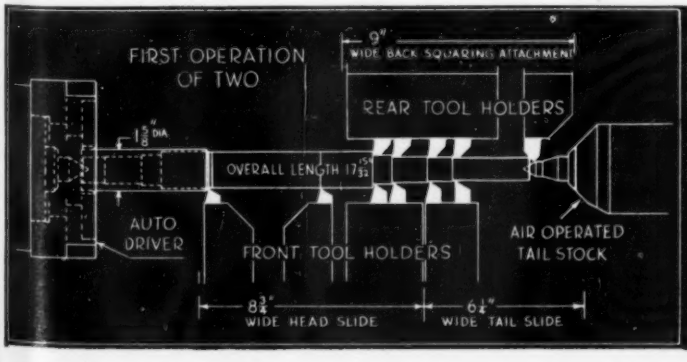
***Problem*: To provide a battery of automatic lathes capable of increasing production on electric motor shafts, but having the quick change-over features necessary for medium and short run work.**

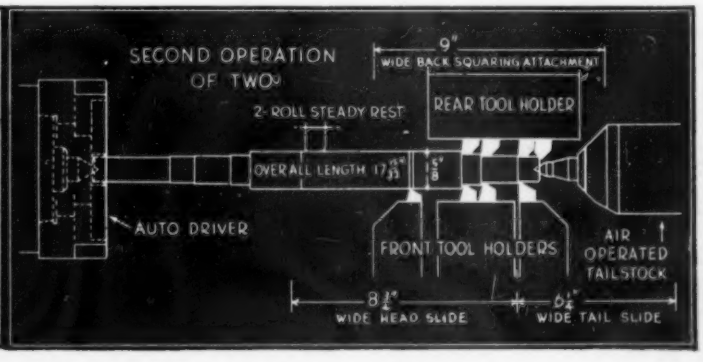
***Solution:* The Model LR Automatic *Lo-swing* Lathe was selected for this job because of its SIMPLIFIED CHANGE-OVER MECHANISM which makes change-over from job to job merely a matter of a few minutes' adjustment. With this built-in mechanism, length of carriage stroke and rapid traverse movements are quickly adjusted and positioned to readings on graduated dials. Cams are standard and do not have to be changed, and since the cycle is closed and locked, the machine cannot get out of time. Average change-over time is 20 to 30 minutes, depending on the number of tools being used.**

Line drawings show the two turning operations on one type of motor shaft. The total length of carriage travel for the first operation is 5-7/8", and a production of 20 shafts per hour at 85% efficiency can be maintained with high speed steel cutting tools.

The total length of carriage travel for the second operation is 2-3/4" and a production of 36 shafts per hour at 85% efficiency can be easily maintained.

Seneca Falls engineers will be glad to assist you with your war production turning problems.





LATHE NEWS from SENECA FALLS

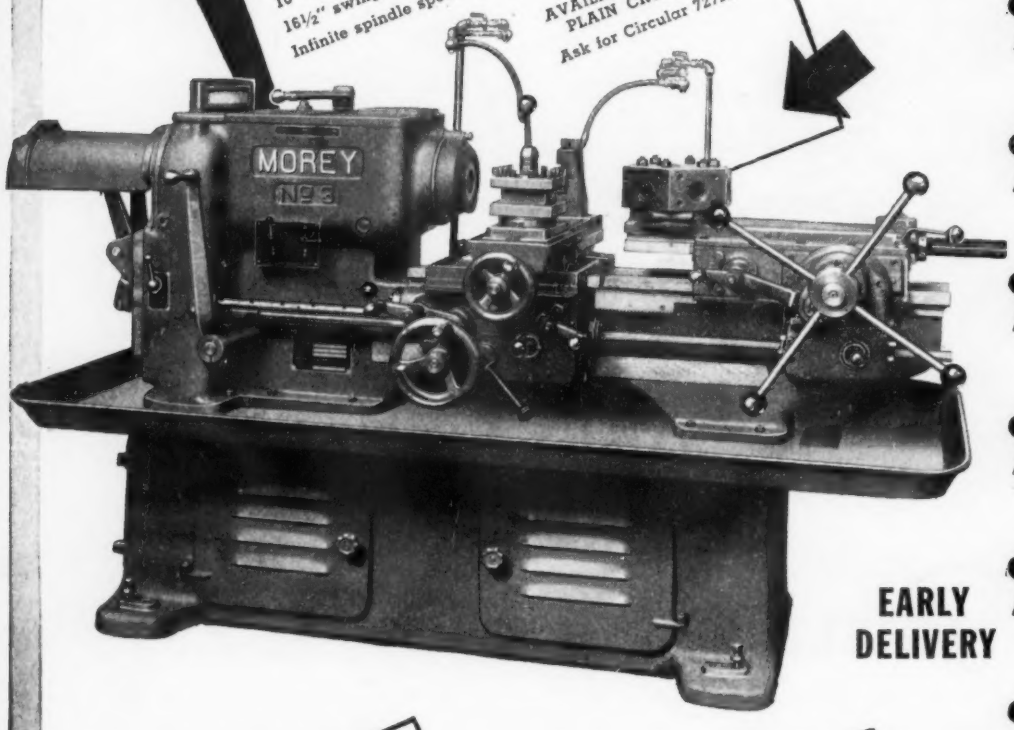
MOREY TURRET LATHES

for BAR or CHUCKING { UNIVERSAL or PLAIN

#3 UNIVERSAL

For bar stock up to 1½" in diameter
10" turning length
16½" swing over bed
Infinite spindle speeds: 55 to 1800 RPM, constant speed motor, 1200 RPM

AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 727A



EARLY DELIVERY

- INFINITE SPINDLE SPEEDS —Electrically Selected—
- DIRECT BELT DRIVE AVAILABLE AT HIGH SPEEDS ELIMINATES GEAR MARKS (patents applied for).
- GEARED SPINDLE SPEEDS INSTANTLY AVAILABLE THROUGH MULTIPLE DISC CLUTCHES.
- SPINDLE MOUNTED ON TIMKEN BEARINGS.
- RIGID—WITH SUFFICIENT POWER TO TURN AT THE HIGHEST SPEEDS AND FEEDS *MODERN* TOOLS WILL WITHSTAND.
- SPINDLE SPEEDS AND POWER FEED CHANGES WITHIN EASY REACH OF OPERATOR.
- BED MOUNTED ON CABINET BASE.
- MOTORS AND STARTING EQUIPMENT EASILY ACCESSIBLE.
- HEXAGON TURRET AUTOMATICALLY UNCLAMPED, INDEXED AND CLAMPED.
- THREE TYPES OF CROSS SLIDES AVAILABLE:
  Lever Feed
  Screw Feed
  Combination Feed*
- *Combination feed provides instantaneous selection to either lever or screw feed.
- EIGHT (8) FEED CHANGES FOR THE UNIVERSAL CARRIAGE and HEXAGON TURRET, INSTANTLY ENGAGED OR DISENGAGED BY ONE MOVEMENT OF THE LEVER.

#2 PLAIN-GEARED

For bar stock up to 1" in diameter
Turning length 6½"
Swing over cross slide 6"
Swing over bed 14"
Infinite spindle speeds:
Minimum of 60 RPM.
Maximum of 2000 RPM.
Constant horsepower at all speeds.
Ask for Circular 629A

#4 UNIVERSAL

For bar stock up to 2" in diameter
12" turning length
19½" swing over bed
Infinite spindle speeds: 35 to 1500 RPM, constant speed motor, 1200 RPM

AVAILABLE ALSO WITH PLAIN CROSS SLIDE
Ask for Circular 736A

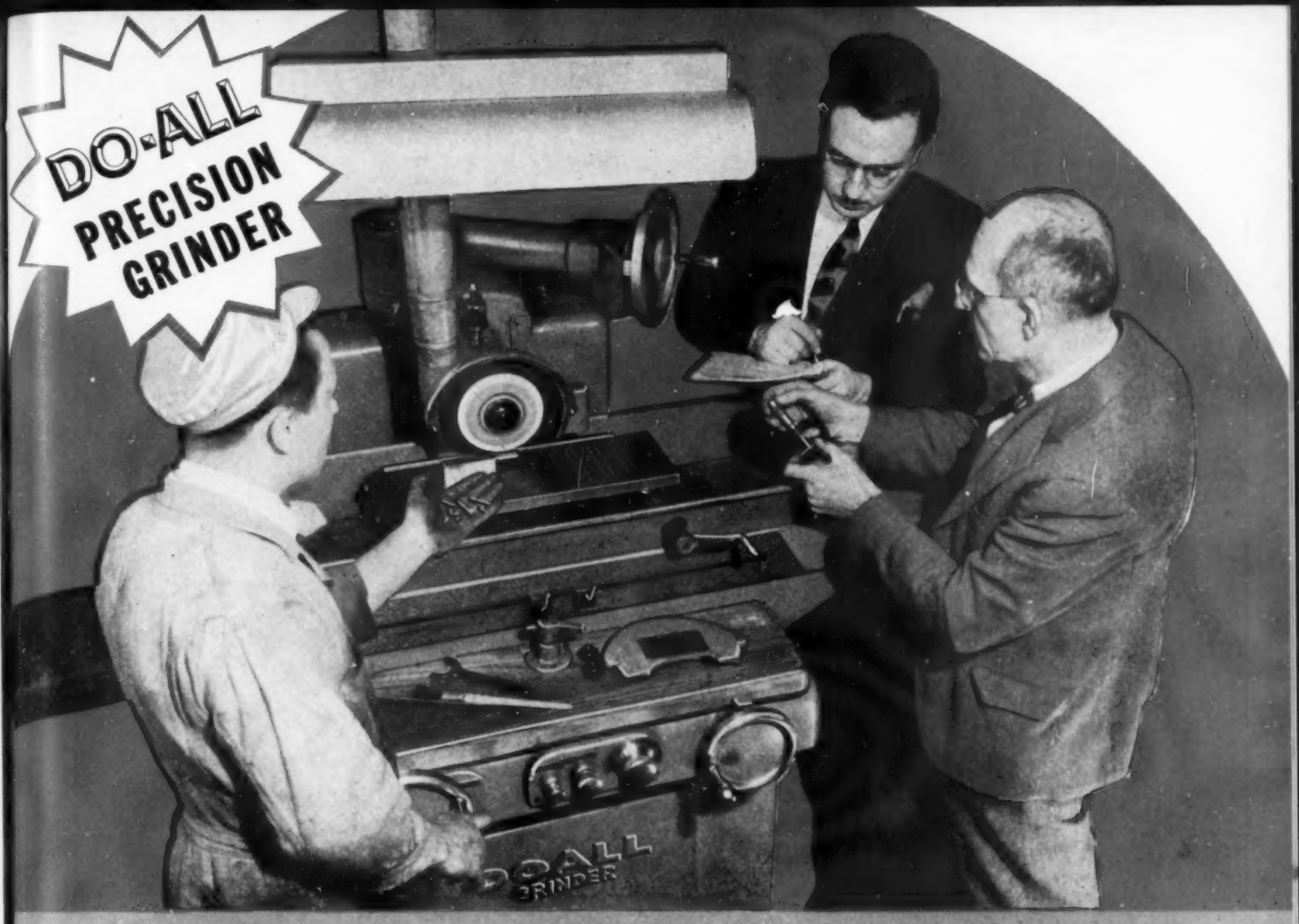
ARMY E NAVY

THE DESIGN OF THE MOREY No. 2, 3 and 4 TURRET LATHES ARE BASICALLY ALIKE. EACH MACHINE IS ENGINEERED FOR THE SIZE WORK IT IS DESIGNED TO HANDLE.

DESIGNED AND BUILT BY

MOREY MACHINERY CO., INC

410 BROOME STREET, NEW YORK, N. Y. *Plant* 4-57 26TH AVE., ASTORIA, NEW YORK



.0001" Tolerance on 4 Sides

In one modern Pennsylvania plant, keys ranging in size from ¼ to 1⅛" wide and from ⅛ to ⅜" thick were ground to give a .0001" tolerance on 4 sides over all. There was only 1 reject in 2500 pieces.

THE DO-ALL HAS EVERYTHING

Here's a direct drive Surface Grinder with 1140 square inches of hand scraped bearings and mechanism safely sealed inside. A magnetic chuck holds work firmly without clamps. Vibration is practically nil because the DO-ALL is sturdily built—weighs more than a ton. Adaptable to wet or dry grinding. Comes in two models.

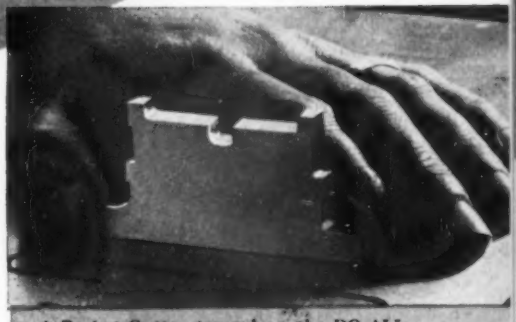
You'll like the DO-ALL—it's easy on the operator, easy on the work and easy on your budget. It will turn out super-smooth jobs for you in quick time and has a ruggedness that will stand the gaff of continuous operation long after other equipment has given up the ghost.

Send for data about the two DO-ALL models.

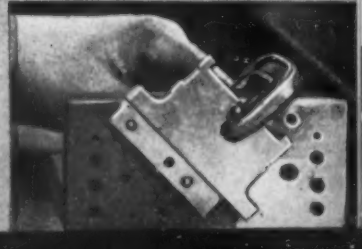
SAVAGE TOOL COMPANY

DEPT. AM, SAVAGE, MINN.

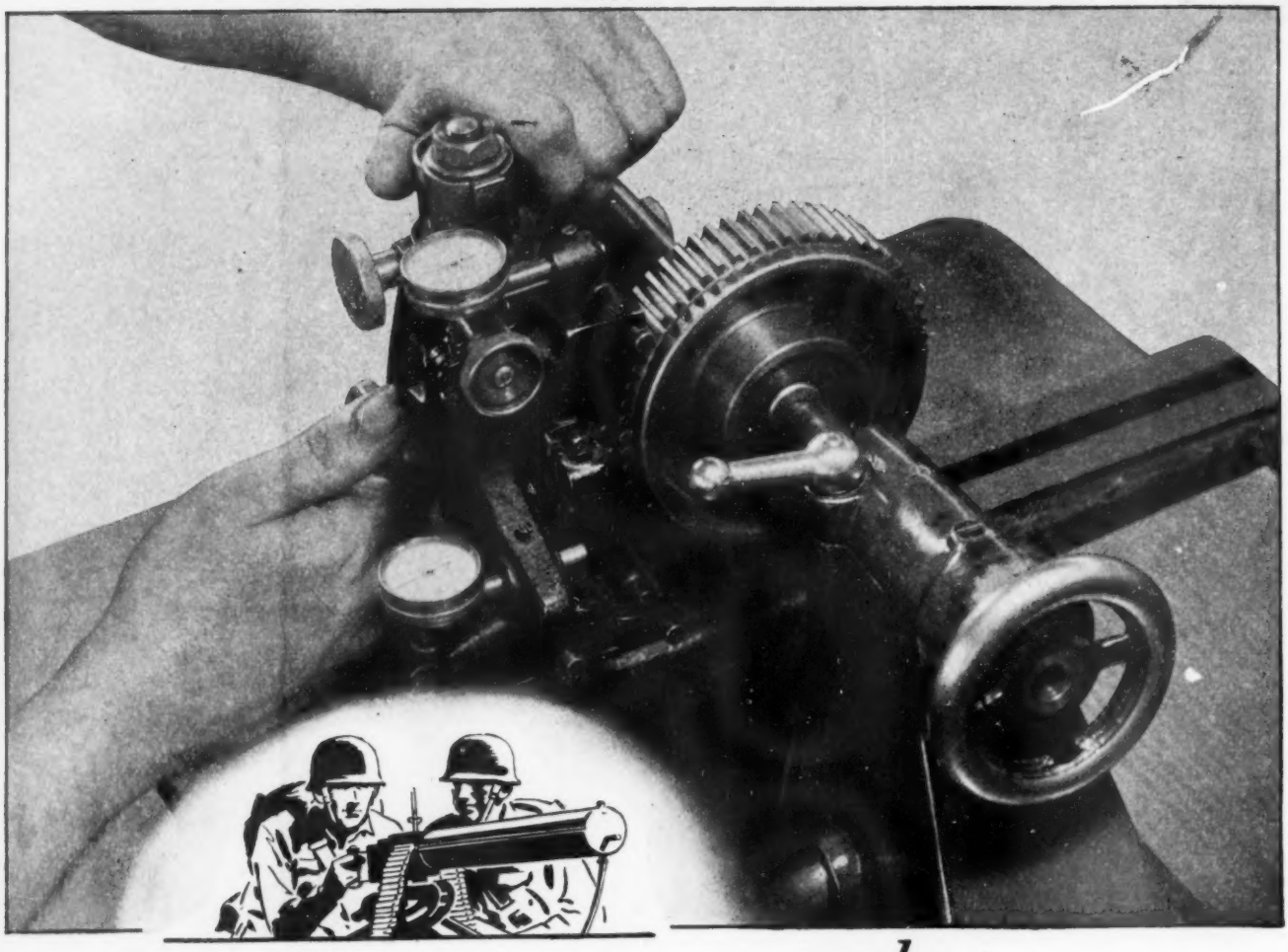
DO-ALL Offices in 25 cities, with a staff of trained engineers to give you quick service on Surface Grinders, Gage Blocks, Contour Machines, Band Saws and Files.



A Boring Cutter ground on the DO-ALL. Two cutting edges ground to .001. Clearance and step-down ground to .002. Keyway ground from side to side to .0001.



Fixture used to hold the Boring Cutter to 45° angle, tolerance held to .001.

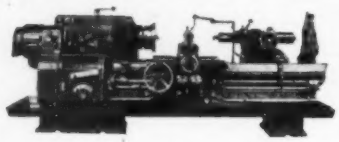


Little things can ~~ruin~~ *make* a job

Bullets from a machine gun or teeth on a lathe gear must be true to the mark — or else.

On battle field or factory floor we can't afford to miss. Should a precision piece of work being turned on a lathe be spoiled the reject means loss of vital metal, doing the job over and most important of all, delay in delivering battle weapons that might have saved some soldier's life.

During the production of a single Axelson Lathe, its parts receive a multitude of tests and inspections. Spacing of gear teeth is checked by the dual-dialed Swiss tester shown above. Tension and compression capacities of the metal are tested in a machine capable of developing up to 100,000 pounds; degrees of hardness are determined by the Rockwell tester and by the Brinell method; grain structures are examined microscopically. Headstock alignments are tested to .0001", while cross-slide alignment is checked with the standard face plate furnished with each lathe. Skilled inspectors, provided with every needed precision measuring device, check every essential dimension.



Axelson Lathes afford a wide range of operating speeds and feeds necessary for fast production. Manufactured in 14, 16, 18, 20, 25 and 32 inch sizes, in varying lengths.

Inflexible Axelson standards, fixed over twenty-five years of machine-tool manufacture, are your guarantee that the little things in your precision work will be perfect. That guarantee is yours today and it will go with every Axelson Lathe that you buy — in the future.

AXELSON MANUFACTURING COMPANY
6160 South Boyle Ave., Los Angeles, Calif.
(P. O. Box 98, Vernon Station)
50 Church Street, New York City, N. Y.
3844 Walsh Street, St. Louis, Missouri

Buy More War Bonds For Victory

AXELSON LATHES

THERE IS NO ECONOMICAL SUBSTITUTE FOR QUALITY

ARMY NAVY

DEPENDABLE FOR OVER A QUARTER CENTURY

NOT A CLAIM
NOT AN OPINION

But a Fact..

You can get better, faster and more accurate threading and beat your production schedules with

MURCHEY

Threading Tools

4 WEEKS' DELIVERY

TYPE "C-O" (rotating) SELF-OPENING DIE HEAD—Designed and engineered for use on any machines where die heads are revolved. Made in sizes from 7/16" up to and including 4".

TYPE "G" (non-rotating) SELF-OPENING DIE HEAD—A companion to type "C-O" for use on hand screw machines or automatic machines where the die head does not revolve. Takes the same chasers as well as many parts of type "C-O".

Every day, and in the face of exacting government specifications, Murchey self-opening dies and collapsible taps are proving this on threaded parts for tanks, guns, bombs and shells. They are cutting threads to class 3 fits in aircraft parts, tapping the noses of shells and bombs and threading the base end of anti-aircraft shells. The record of these tools is outstanding.

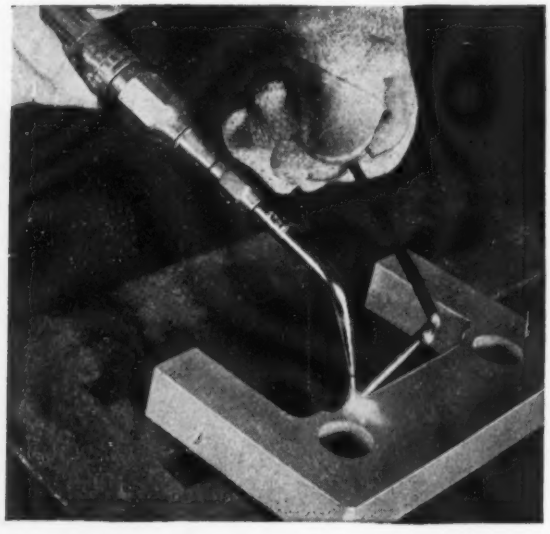
Write for literature on type "C-O", type "G" and on our New Collapsible Machine Tap Type "B-M". Also for folders on Murchey Milling Machines, Shell Tapping Machines and Roller Pipe Cutting-off Machines. You need this literature in your files for ready reference. Address Dept. A.

MURCHEY MACHINE & TOOL CO.
DETROIT 26, MICHIGAN

Always remember—machines must be in perfect alignment to cut perfect threads.

MURCHEY

Metals that can be Hard-Faced to make wearing parts last longer



Hard-facing is of particular importance today because when vital parts that are subjected to wear are hard-faced with rods made by Haynes Stellite Company, they last from 2 to 25 times longer. This helps to keep essential machines and equipment in service, and eliminates the needless scrapping of parts, excessive down time, and delays in production. Usually the amount of hard-facing material required is only a small percentage by weight or volume of the part to be protected.

Most of the commonly used metals can be hard-faced successfully. The following classification affords a means of determining what metals or alloys can or cannot be hard-faced, and by what method.* For more information, write for the booklet, "Hard-Facing With Haynes Stellite Products."

Carbon Steels (plain carbon steels up to 0.60 per cent carbon) — These can be hard-faced successfully either with the oxy-acetylene* or the metallic-arc process.

High-Carbon Steels (steels with carbon above 0.60 per cent)—Proper heat-treatment both before and after hard-facing, by either process,* is advisable to prevent failure of the base metal because of its hardness and brittleness.

Low-Alloy Steels—These can be hard-faced in much the same manner as plain carbon steels, but in some cases heat-treatment is required after welding.

High-Speed Steel—The hard-facing of this group of steels is not recommended. They can be hard-faced without any trouble in so far as technique is concerned, but shrinkage cracks and strain checks frequently render the hard-faced piece valuless, regardless of heat-treatment.

Manganese Steel—Can be hard-faced successfully, using the metallic arc process.

Stainless Steels (18-8 chromium-nickel steels)—These steels can be readily hard-faced by either the oxy-acetylene process* or the metallic arc process. In some instances, heat-treating is required.

Straight-Chromium Steels (4-6 and 11-13 per cent chromium steels)—Can be hard-faced by either process.* To avoid cracking of the deposit, the part must be preheated almost to a red heat and cooled slowly, preferably in a furnace.

Cast Iron—Cast iron can be hard-faced by either process.* The procedure is different from that of steel because of the lower melting point of cast iron.

Chilled Iron—Small parts can be hard-faced with either the oxy-acetylene* or metallic arc process. On large parts difficulty is usually encountered.

Alloy Cast Iron—The procedure for hard-facing this material is the same as for ordinary gray cast iron.

Monel—Monel is easily hard-faced with the oxy-acetylene process.

Brass and Bronze—Because of their low melting points, these alloys cannot generally be hard-faced.

Copper — Because of its low melting point and high heat conductivity, it is best to use the metallic arc for hard-facing copper, preheating to a red heat.

Aluminum — Aluminum or its alloys cannot be hard-faced.

*For the majority of hard-facing applications, the oxy-acetylene process is generally used. The blowpipe allows close control over the operation and produces a smooth deposit. Particles of scale and foreign matter can easily be eliminated, and edges and corners can readily be formed. Other advantages include the elimination of rod loss due to vaporization or spattering, and accurate control over the degree of penetration.

★ BUY UNITED STATES WAR BONDS AND STAMPS ★

HAYNES STELLITE TRADE MARK

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Ind.

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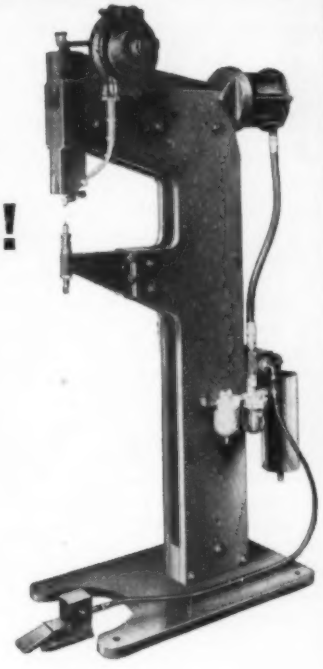
HARD-FACING RODS FOR EVERY PURPOSE

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

Automatic Feed Riveting

for AIRCRAFT PRODUCTION!



Designed to handle exclusively aircraft (aluminum alloy riveting) production... this new Air Powered RIVITOR averages 1600 riveted joints per hour... with no manual rivet handling. Combines Air Squeeze action with automatic feeding and setting. Soundly engineered... ruggedly built ... meets today's needs for *speed, accuracy* and *cost-cutting efficiency!* Write for new catalog RP-1.

FOR TOUGH JOBS... SPECIFY T-J

TOMKINS-JOHNSON

RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

Better Performance

in HYDRAULIC POWER MOVEMENT!

Get *maximum* power output and efficiency in hydraulic cylinders... by specifying T-J! Easily and quickly installed. T-J Hydraulic Cylinders avoid excessive pressure losses due to friction ... their advanced design assures that initial high mechanical efficiency is continuously maintained. Available in types and sizes to exert power movement from 1000 to 50,000 lbs. (direct). Write for Bulletin H-40. The Tomkins-Johnson Co., Jackson, Michigan.

TWO *BEST BETS!*

SIMMONS No. 2 TURRET LATHE

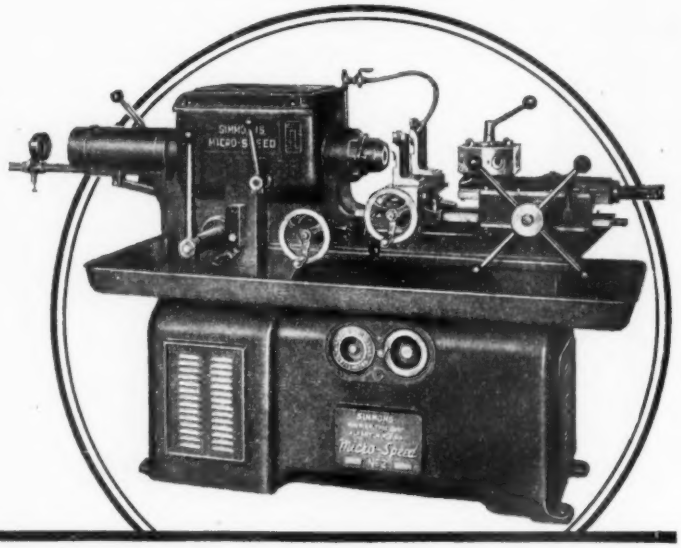
- MICRO-SPEED DRIVE
- SELECTOR DIAL CONTROL
- SPINDLE BRAKE & CLUTCH

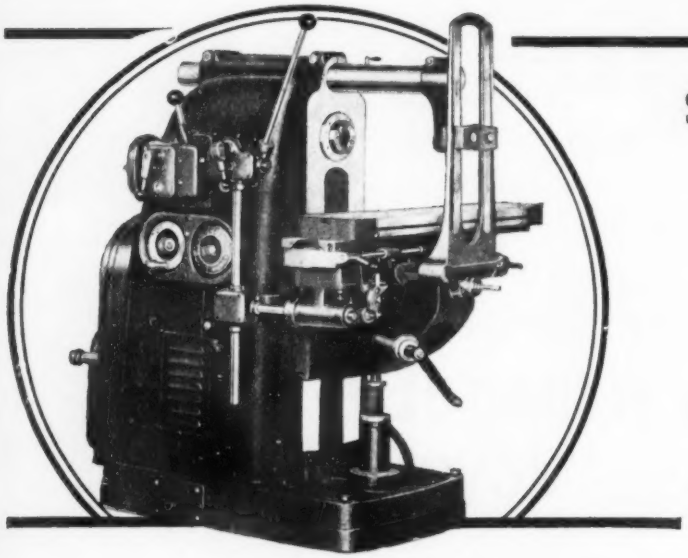
Recently the editor of a leading metal-working publication specializing in screw machine operation visited a plant employing several batteries of Simmons No. 2 *MICRO-SPEED* Turret Lathes. "We were amazed," he wrote, "at the number of diversified parts that were being turned out on these machines with very little special tooling items in use. In fact, many of the turret lathes did not have what could be termed a 'special tool' in their entire set-up."

Therefore, whether your plant has converted to war work or continues to make standard products, Simmons Turret Lathes will prove a production standby. They produce close-tolerance work speedily and economically. The MICRO-SPEED Drive offers unlimited speed variation and all changes can be made while the spindle is in operation. This enables quick selection of the speed best-suited to the work and cutting tools. *Ask TODAY for full details and delivery dates.*

SPECIFICATIONS

Bar Capacity—1¼"; Swing over bed—14";
Swing over cross-slide—6".
Made in Plain and Back-geared types
(latter shown in illustration)





SIMMONS No. 1A MILLING MACHINE

Because inexperienced operators learn to produce small, high-precision parts quickly, Simmons No. 1A Micro-Millers will help solve your skilled-labor shortage. These sturdy, versatile milling machines are equally efficient on long production runs or small-lot work requiring frequent set-ups.

Through *MICRO-SPEED*, a unitized A.C. motor and variable speed drive mounted on a hinged bracket in the column, spindle speed changes are made while the spindle is in operation. A direct-reading index plate shows the speed obtainable at each position of the Selector Dial. Thus the operator can easily determine the spindle speed best suited to the work and cutting tools. *Write TODAY for full details and delivery dates.*

SPECIFICATIONS

SPEEDS: 64-710 R.P.M.

RANGE OF FEEDS: Horizontal, 34"; Cross, 8";
Vertical, 18½"

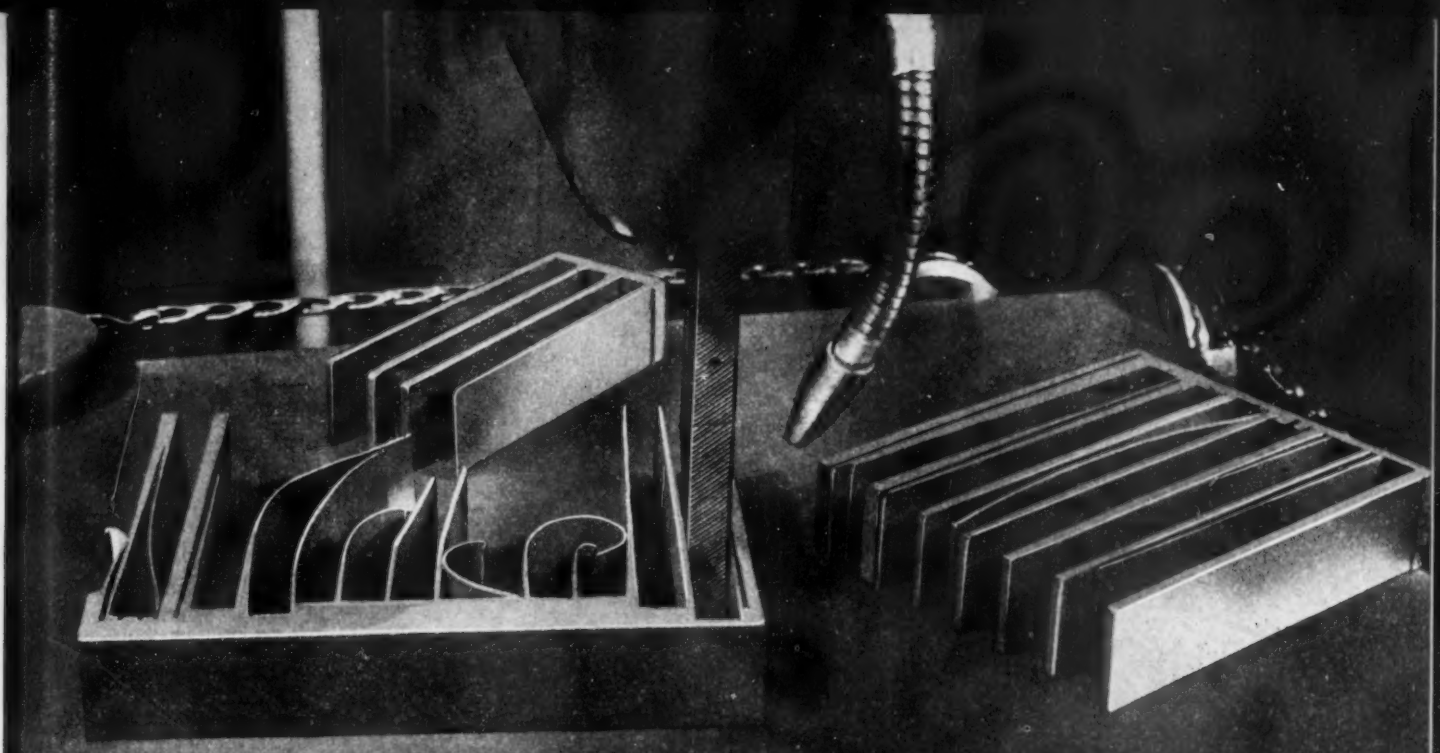
- MICRO-SPEED DRIVE
- SELECTOR DIAL CONTROL
- SPINDLE BRAKE & CLUTCH

SIMMONS MACHINE TOOL CORPORATION

Main Office: 1759 NORTH BROADWAY, ALBANY 1, N. Y. *New York Office:* 149 BROADWAY

SIMMONS

LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES



50 HOURS AND NO SIGN OF WEAR

● This ⅜" DO-ALL File Band was recently used on a 75" Continental Band Filer to file Sandvik oil hardening tool steel (hardness 74-77 30T) 1" thick. Light feeding pressure of 12.5 pounds was applied to the work. After 50 hours of continuous filing at a velocity of 100 feet per minute, the file band was still sharp and cutting good. At no time was there loading of the teeth. A total volume of 39.88 cubic in. of materials was cut.

Separate Segments Lock Firmly into a Strong, Continuous File Band.

DO-ALL BAND FILES

Developed by top-ranking metallurgical engineers to wear longer and give you a smooth finish in double-quick time. DO-ALLS meet today's demands for different styles and widths to suit every kind of material. You can't go wrong if you consult the DO-ALL File Chart for the best file and speed to use for each job.

Free File Clinic—Let us help improve and speed up your filing production. Send us any difficult job. We'll put it through every test and give you a written laboratory report. Or, consult the DO-ALL man in your locality for valuable aid right in your own plant.

New File Booklet

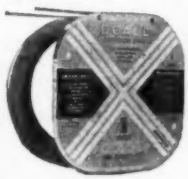
Tabloid form, well illustrated. Easy reading for busy people. All about DO-ALL Band Files.

THE DOALL COMPANY

1210 Thacker Street **Des Plaines, Illinois**

DO-ALL Offices in 25 cities, with a staff of trained engineers to give you quick service on DO-ALL Band Files and Saws, Contour Machines, Gage Blocks and Surface Grinders.

DO-ALL BAND SAWS

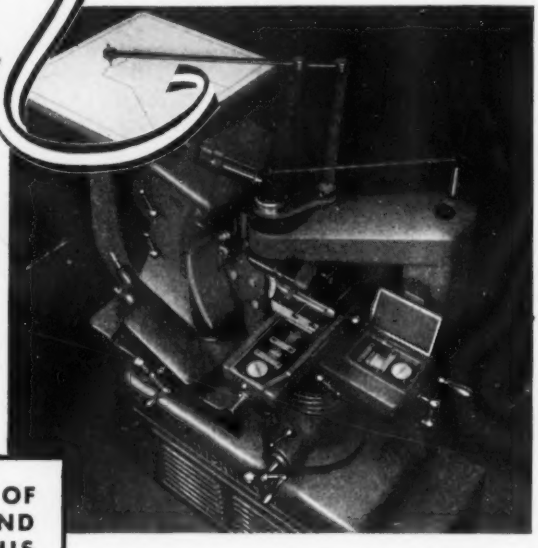


A wide range of styles and sizes. 100 ft. in each Strip-Out Container

Grinds ANY DESIRED PROFILE

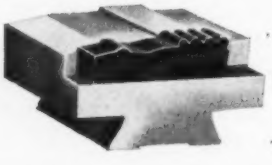
IN TUNGSTEN CARBIDE OR OTHER HARD METALS

DIRECTLY from the drawing



Looking down on the Wickman Profile Grinder showing layout, pantograph, microscope and work table assembly.

TYPICAL EXAMPLES OF WORK GROUND AND INSPECTED ON THIS MACHINE WITHOUT USE OF RADIUS DRESSER OR FORMED WHEEL



Tungsten Carbide Tipped Form Tool
Width of Carbide tip . . . . 1¾"
Depth of Cut . . . . . .150"
Stock removed . . . approx. .040"
*Grinding time . . . . . 3½ hrs.

Tungsten Carbide Tipped Form Tool
Width of carbide tip . . . . . ½"
Depth of cut . . . . . .240"
Stock removed . . . approx. .040"
*Grinding time . . . . . 1 hr.

*Includes setup and complete inspection of contour before removal from machine.

The Wickman Profile Grinder has demonstrated its precision and efficiency in the plants of a number of the country's most important manufacturers. In 1941 it introduced a new method of profile grinding to American industry—a process in which a 50 times size layout, a pantograph system, microscopic inspection, and a universal grinder are coordinated to produce profile grinding to an accuracy within ± .0005". It is now being used to grind flat and circular form tools, punches and die segments, profile gages, special cams, templates and many other irregular parts from a wide variety of materials including tungsten carbide.

The first of these Wickman Profile Grinders were designed and built to conform to basically sound and thoroughly tested engineering principles. With the improvements which have since been made, the present machines offer the utmost in efficient, trouble-free performance.

A completely descriptive folder covering today's Wickman Profile Grinder is yours for the asking.

WICKMAN PROFILE GRINDER

THE Wickman CORPORATION
15537 WOODROW WILSON
DETROIT, MICHIGAN

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

★

Good advertising speeds information from those who have it . . . to those who need it.

★

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330 West 42nd Street New York

DALZEN *Broaches*

ROUND AND FLAT . . . IN A COMPLETE SIZE RANGE

For maximum parts per grind plus maximum grinds per broach specify Dalzen broaches.

Dalzen broaches are ground from your blueprints by precision craftsmen with years of experience in broach making. Flat broaches are available in any size; round broaches, in any size up to 72".

When ordering, give make and number of machine, length of stroke, and type of holder.

A DALZEN WILL DO IT! Dalzen tools — taps, flat and round broaches, thread milling hobs — have the same high reputation for accuracy and dependability as Dalzen Thread Grinders and Center Lapping Machines. Sturdy, compact, efficient, Dalzen machine tools give maximum production per cubic foot, per pound, per dollar of cost! Write for descriptive literature.

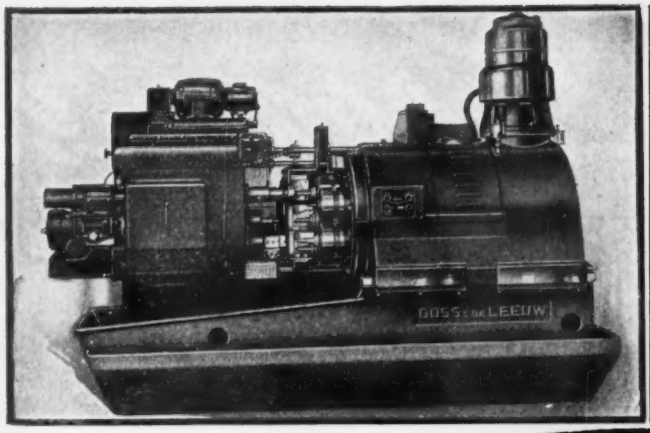
DALZEN IN AIRCRAFT

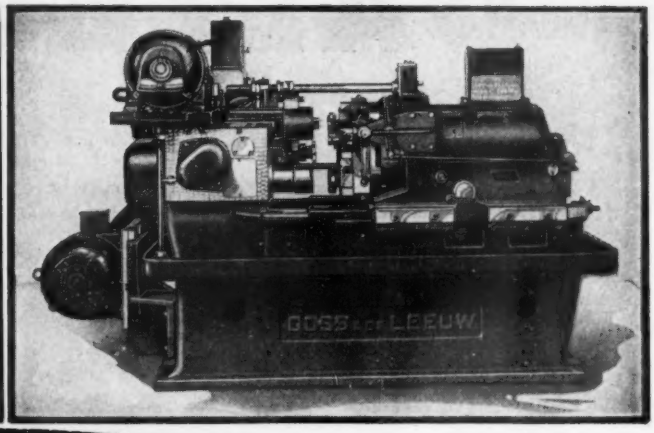
Ground thread parts are being produced on contract for leading aircraft engine manufacturers. For detailed data on this service, submit blueprints and specifications when making inquiry.

DALZEN

TOOL & MANUFACTURING CO.

12255 EAST 8 MILE ROAD • DETROIT





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

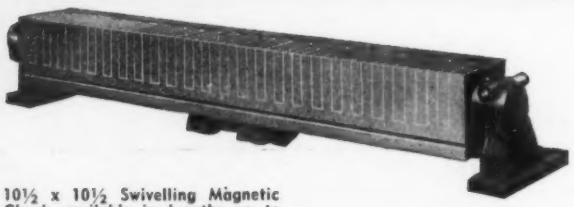
4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

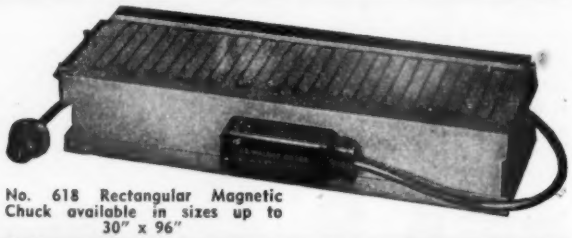
Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.



10½ x 10½ Swivelling Magnetic Chuck available in lengths up to 207"



No. 618 Rectangular Magnetic Chuck available in sizes up to 30" x 96"

Your every need can be met with

DEMAGNETIZERS

Send for a copy of Bulletin K7 giving complete information on Walker D.C. and A.C. Demagnetizers. These units —in 110 and 220 v.—are suitable for removing residual magnetism from a wide variety of work, are convenient and highly efficient.

WALKER MAGNETIC CHUCKS

Aside from the fact that Walker Magnetic Chucks are of tried and proved design and construction, the big advantage in coming to Walker for your needs is the fact that you can be certain that you will exactly meet your needs. Regardless of your requirement, there's a Walker to handle it.

The completeness of the Walker Magnetic Chuck line makes it possible for you to standardize on these well-known and widely accepted units. Every type of magnetic chuck is available in a wide range of standard sizes including Rectangular, Swivelling, Vertical Face and Rotary. Every design is modern, convenient, with maximum uniform magnetic strength over the entire surface.

Get all the details pertaining to sizes, types and construction by wiring today for a copy of Bulletin W4.

Also

Walker is prepared to furnish promptly and at reasonable price any special magnetic chuck that may be required for special service conditions. Outline your problem and ask us to submit details and quotation.

Style B Face Plate for Standard Rotary Type Chucks available in sizes up to 66" diam.

No. 410 Universal Swivelling Magnetic Chuck

O. S. WALKER CO. Inc., Worcester, Mass.

ask for this 7-MINUTE STORY

ABOUT A NATIONAL TOOL-ENGINEERING SERVICE

Here's the brief factual report of how the **HECKER** organization designs and builds production tools for many industries—both large and small.

Perhaps it suggests a solution to some of *your* tooling problems. If there's the slightest possibility of your needing outside specialized service on production tooling—make a request for your copy of this **HECKER** booklet to the nearest A. W. Hecker office (addresses below)—mention Dept. E.

A·W· Hecker

DESIGNERS AND BUILDERS OF TOOLS, JIGS AND FIXTURES—FABRICATORS OF AIRCRAFT PARTS

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1976 East 66th St.	1775 Broadway	443 Delaware Ave.	517 New Center Bldg.	332 So. Michigan Ave.	3723A Wilshire Blvd.

...avenging "Torpedo 8"

"Wright engines powering Avenger torpedo planes have performed in brilliant style"... recently stated a Navy Executive, "...and helped to revenge the Torpedo Squadron 8, wiped out almost to a man during the battle of Midway." *The Avenger is powered with the Cyclone 14 Engine.*

SCHAUER Speed Lathe finishing parts of the *Cyclone 14 Engine* at the Wright Aeronautical Corp. plant in Ohio.

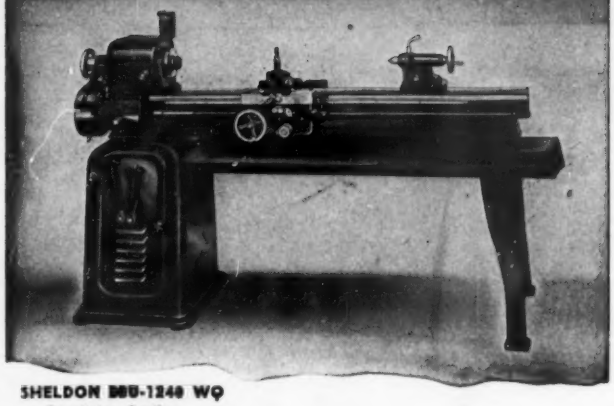
Best Performance with
Precision Finishing

Magneto shafts for the *Wright Cyclone 14 Engine* are burred and finished for a precision fit with the **SCHAUER Speed Lathe** after each of four cutting operations. *These parts must be accurate — lives depend upon their performance.* For finishing, burring, polishing, lapping of small metal or plastic parts use **SCHAUER IDEAL Speed Lathes.** Many *standard* models.

SEND FOR CATALOG NO. 420

"the originators of today's Speed Lathes"
SCHAUER MACHINE CO.
2067 READING ROAD CINCINNATI, OHIO.

SHELDON



SHELDON BBB-1240 WQ
Precision Lathe

★ This quality 12 in. ball bearing tool room lathe is built for precision work and will retain its accuracy under long and hard usage. It has extra collet capacity (to 1" round), the finest precision ball or roller bearings obtainable, an improved heavy-duty, double wall apron with power cross feed; full quick change gears and full bowl headstock. Its improved Sheldon 4-speed, V-belt, lever-clutch operated, underneath motor drive is entirely enclosed in the pedestal leg and has anti-friction bearings. It is so designed that spindle belts operate thru a *standard* 1-piece bed. This bed is bridge-braced with heavy cross girts and has hand scraped ways—2 V-ways and 2 flat ways.

★ If interested in 10", 11" and 12" quality lathes be sure to see the SHELDON.

SHELDON MACHINE CO., INC.
4234 N. Knox Ave. Chicago, U.S.A.

Keep this Point in Mind

FEATURES of SUPERIORITY

MOTOR TOOL Ball and Roller Bearing LIVE CENTERS

are as nearly FRICTION-FREE *as scientific engineering can make them*

Chances are you will wear out a dozen "dead" centers before you even have to dress the point of a MOTOR TOOL. And, in a MOTOR TOOL, there still are years of service if run at rated loads and speeds.

a vital point to keep in mind when buying centers

MOTOR TOOL MANUFACTURING CO.
METAL CUTTING TOOLS
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Make it a rule to Call Motor Tool

LM LM

REID Hand Feed Surface Grinder No. 2C

Equipped with Motorized Spindle

A Proven Product for Over a Quarter Century with Thousands in Use Daily

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EXCELLENT DELIVERIES

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H. LEACH MACHINERY CO.
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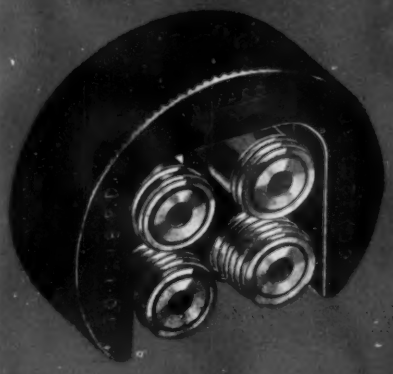


VARD MODEL O-C
Roll Thread Snap Gage

A SMALL, FAST, ACCURATE INSPECTION GAGE...FOR NUMBER SERIES THREADS

This small VARD Roll Thread Snap Gage has all the advantages of the larger size VARD gages.

The gage frame is machined from a block of steel and after finishing is given a special black oxide coating, not soluble in oils or lacquer thinners, and which wears well. Engraving on the gage face is clear.

A sharp, machine knurled grip on the circumference of the frame helps the user to hold the gage steadily and in one position while working.

The frame has open ends so that long threaded screws may be tested over their entire length.

The threaded testing rolls are precision ground and lapped from special alloy, tool steel and are finished and set to the tolerance specified.

LOOK FOR THIS MARK

VARD
PASADENA, CALIF.

ON ALL VARD PRODUCTS!

EASY TO HOLD...AND EASY TO USE...BY MEN OR WOMEN INSPECTORS

This fine, precision testing gage is only .763 in. thick and 1.625 in. in diameter. Weighing but 4 oz., it fits readily into the smallest adult worker's hand, and can be used all day without tiring. Only two motions are necessary to fully gage threads. This operation is much faster than screwing on and off ring gages. Moreover this gage can inspect work still in the machine. It affords a visual as well as manual feel check on the accuracy of cut threads. It will gage the pitch diameter, thread form, and lead of threads. It can be used to check threads flush against a shoulder.

The 5/16 in. long, gaging rolls are set and sealed on eccentric pins which can be reset in our plant to compensate for wear. This service may save you considerable cost if gages are given hard service.

VARD O-C Roll Thread Snap Gages are made to gage threads in size from No. 0 NF series to No. 14-20 NS series. Finer threads, special pitches, Metric or left hand threads can be made on specification.

VARD INC.

PASADENA, CALIFORNIA, U.S.A.

ONE PASS OF THE WORK THROUGH THE GAGE CHECKS THE ACCURACY OF SCREW THREADS. THE WORK SHOULD PASS THROUGH THE GO ROLLS AND BE STOPPED BY THE NO GO ROLLS.

You Get WIDE SPEED

Data from a few actual installations

SPEED RATIO	RPM	APPLICATION	RESULTS
100 : 1	50 to 5000	Drive for magneto testing	Faster and more accurate testing
100 : 1	30 to 3000	Drive for material-testing machine	Constantly increasing rate of tension maintained until material breaks
25 : 1	100 to 2500	Lathe-headstock drive	Increased cutting range and fewer gear changes
20 : 1	85 to 1700	Spar-mill drive	Greatly increased output
3 : 1	1000 to 3000	Drive for machine used to test airplane-propeller governors	More complete test data, as well as speed and precision of testing

NOTE: Likewise, the speed range of Thy-mo-trol drive can be built to suit the requirements of your application. May we discuss your requirements?

GE

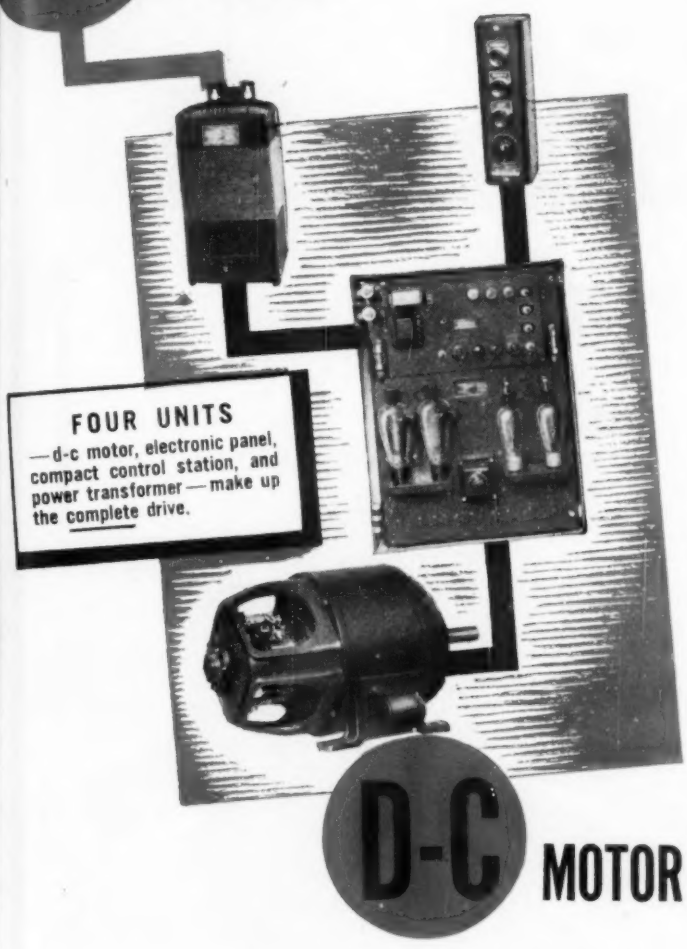
THY-MO-TROL DRIVE

Where Else Can It Be Applied?
Drill presses, to increase speed range and the number of kinds of work handled. Grinders, for precise speed selection and improved finishing. Milling machines, to increase variety of work handled and to simplify design. Cable reelers, to maintain constant tension. Conveyors, to match speeds. Also, automatic arc-welder carriages, weld positioners, pumps, boring mills, automatic screw machines, thread-milling machines, tube-forming machines, alternator speed control, paper and cellophane reels, shell lathes, and numerous other applications.

RANGE *and more*

with THY-MO-TROL DRIVE

A-C POWER



D-C MOTOR

IT gives you speed ratios even greater than 100:1. This new electronic equipment makes available the full, wide speed range of d-c motors—*on a-c* power!

Just a single dial provides this smooth, automatic, full-range control. A single dial—small as a radio volume control, and mounted in the push-button control station—gives complete adjustment of motor speed, from zero to maximum. Thus, you can easily and quickly obtain the exact speed you want, whether, it be for roughing or fine finishing.

Here Are Six OTHER Advantages:

1. Stepless speed control
2. Constant speed under changing load
3. Smooth, fast, constant-current acceleration
4. Low maintenance
5. Speed can be preset before starting
6. No stop for speed change

A Complete Drive

Thy-mo-trol drive takes a-c power from your supply line and, through its d-c motor, delivers torque to your load over a wide range of speeds. Starts, accelerates, controls speed, stops by dynamic braking, and reverses the motor—all from a single, compact control station.

How to Buy Thy-Mo-Trol Drive

Standard Thy-Mo-Trol drives can be obtained in ratings from fractional-horsepower sizes up to 10 hp; higher ratings can also be provided.

This electronic motor control makes possible improved machine design, performance, and operating technique. In order to be sure that you get the full advantage of this new drive, G-E engineers want to consider each application as an individual case. We suggest you get in touch with our local office, giving complete information about your machine for which the drive is required. General Electric, Schenectady, New York.

BUY WAR BONDS

ANOTHER G-E "FIRST" IN INDUSTRIAL ELECTRONICS

GENERAL ELECTRIC

Knock-Out Engineers have an important Announcement to make

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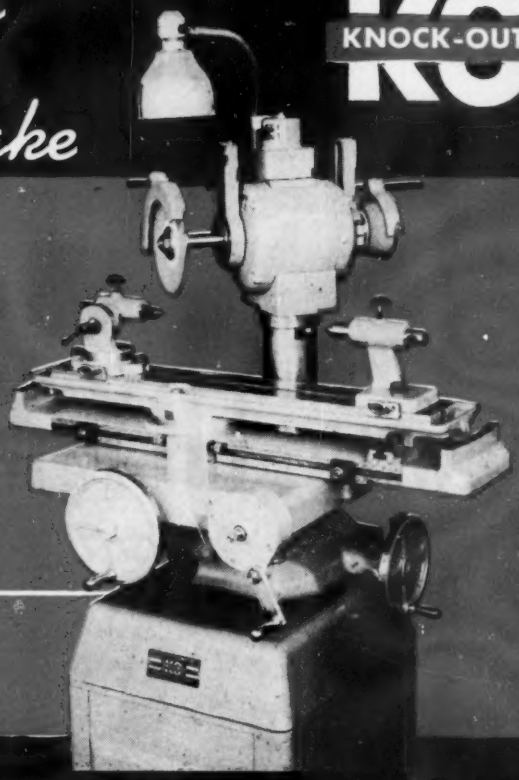
THE MODEL B 600
UNIVERSAL TOOL GRINDER
is now coming off the Assembly line!
IT'S NEW • IT'S FAST • IT'S ACCURATE



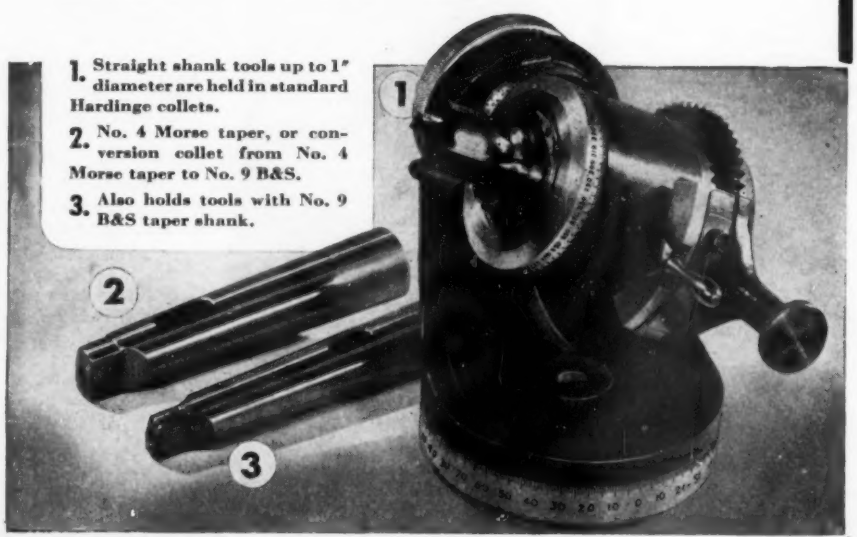
A Production Machine as well as a Tool Grinder . . .
WRITE FOR LITERATURE

K. O. LEE CO., ABERDEEN, S. D.

The ONLY HEAD that takes 'em all!

The UNIVERSAL PRECISION INDEXING HEAD

Can be used on any tool or surface grinder. It holds all the tools shown at the right. Graduated 360° in 3 planes, for every simple or compound angle. Prompt delivery. *Write for illustrated circular.*

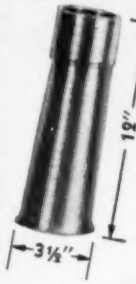

1. Straight shank tools up to 1" diameter are held in standard Hardinge collets.
2. No. 4 Morse taper, or conversion collet from No. 4 Morse taper to No. 9 B&S.
3. Also holds tools with No. 9 B&S taper shank.
1
2
3

CLEVELAND TOOL ENGINEERING CO.
9109 DETROIT AVE. • CLEVELAND, OHIO

From 30 Minutes *and all of operator's time* **to 15.8 Minutes** *and half of operator's time*

Lot Size 200

Both operator and machine worked to capacity to obtain one part every 30 minutes. Time was cut to 15.8 minutes, complete lot finished in half of operator's time.



From 17 Minutes to 7 Minutes

Nine different sizes of these airplane propeller shaft sleeves are turned on a Sundstrand Automatic Lathe. Set-up change-over is less than 30 minutes. Quick set-ups for short runs are made easily.

Lot Size 200

From 45 Minutes to 5 Minutes

Lot Size 30

One of approximately 100 different jobs turned on two Sundstrand Automatic Lathes.

Lot size on the other jobs ranges from 25 to 100 pieces

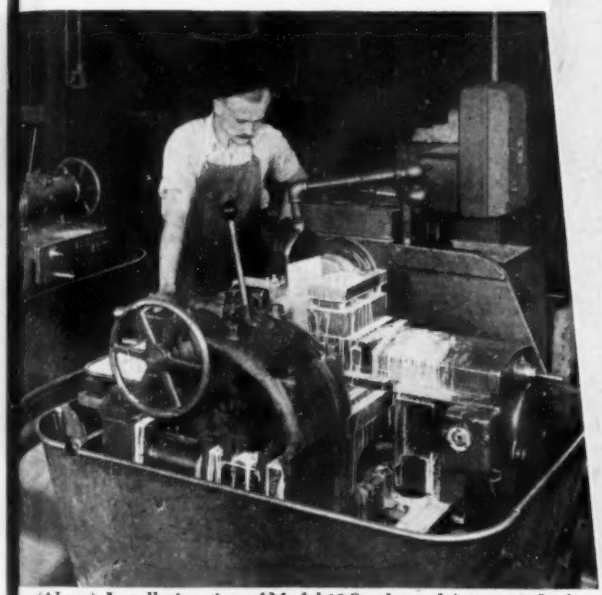
One man operates both machines. Set-up time on all jobs averages 45 min.; savings run as high as 95% over former method.

Are You Losing TIME on Jobs Like These?

Sundstrand Automatic Lathes Increase Production on both Short-Run and Mass Production Turning

These examples of time savings available from Sundstrand Automatic Lathes have been taken from the actual experience of only a few of the many users of this modern equipment.

All of the advantages of multiple-tool turning are available on *both* short-run and mass production work. Study these brief sketches and compare the production figures with parts similar to yours...then get the whole story for equivalent or better savings on turning work in your own plant.



(Above) Installation view of Model 10 Sundstrand Automatic Lathes machining gear blank shown at extreme right, above.

These Exclusive Features Make It Possible to Obtain This Higher Production

Seven machine design features govern the possibility of turning short-run work on Automatic Lathes otherwise limited to mass production turning only. They include (1) Wide range of carriage cycles, (2) Adequate feeds and speeds, (3) Quick cycle change, (4) Simplicity of adjustment, (5) Adequate power, (6) Automatic cycling and (7) High rapid traverse rate. Sundstrand Automatic Lathes have all seven. One of the most important of these is:

Quick Cycle Change for Faster Set-ups . . .

Quicker set-up and easy change-over are possible because of the Sundstrand simple cycle control. This control eliminates making cams for every job to be turned. Another important feature is a:

Wide Range of Tool Action . . .

A wide range of action for front carriage tools is provided by three units used separately or in combination. Many combinations are possible by merely making simple adjustments.

How to Turn Short-Run Work Faster . . . is illustrated in this booklet. Quick set-up and easy change-over features are described in detail. Write for yours today. Ask for Bulletin 115.

(Right and below) Cycle Control Disk

Let Sundstrand Engineers Help You Select the Proper Automatic Lathe to Suit Your Work

...and make tooling suggestions for faster turning of *both* short and long-run work. This competent staff of engineers is available to study your problems and suggest changes for increased production, lower costs. Send complete, accurate information with each inquiry.

SUNDSTRAND MACHINE TOOL CO.

Rigidmils • Fluid-Screw Rigidmils • Automatic Lathes • Hydraulic Equipment • Drilling and Centering Machines • Special Milling and Turning Machines

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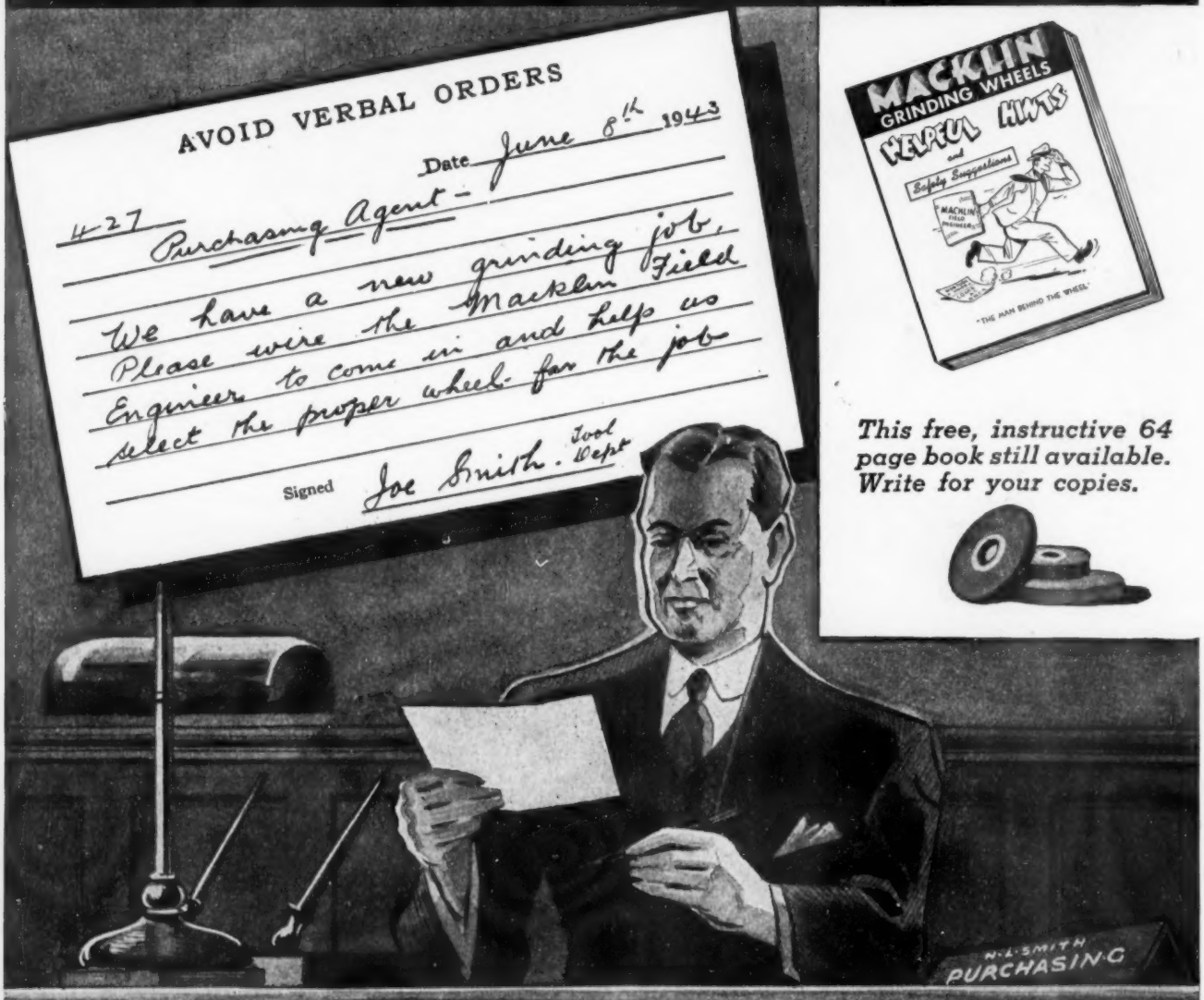
MACKLIN
GRINDING WHEELS

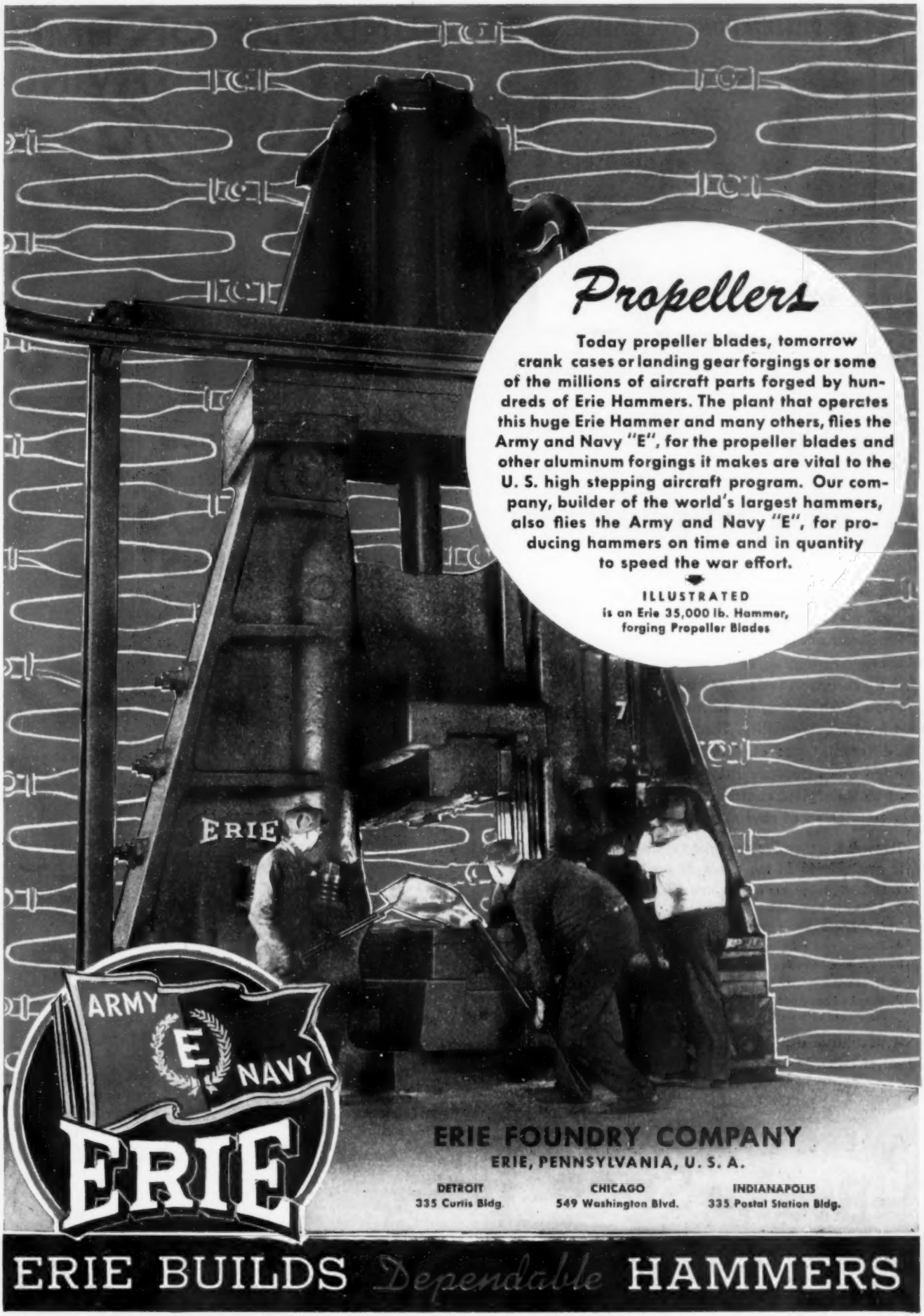


MACKLIN COMPANY

Manufacturers of GRINDING WHEELS — JACKSON, MICHIGAN, U. S. A.

Distributors in all principal cities

Sales Offices: — Chicago - New York - Detroit - Pittsburgh - Cleveland - Cincinnati - Milwaukee - Philadelphia


Propellers
Today propeller blades, tomorrow crank cases or landing gear forgings or some of the millions of aircraft parts forged by hundreds of Erie Hammers. The plant that operates this huge Erie Hammer and many others, flies the Army and Navy "E", for the propeller blades and other aluminum forgings it makes are vital to the U. S. high stepping aircraft program. Our company, builder of the world's largest hammers, also flies the Army and Navy "E", for producing hammers on time and in quantity to speed the war effort.
ILLUSTRATED
is an Erie 35,000 lb. Hammer, forging Propeller Blades
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ERIE FOUNDRY COMPANY
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ERIE BUILDS Dependable HAMMERS

... yet the characteristics required for both castings are found in ABSCO Meehanite.

Produced under four general classifications, ❶ general engineering, ❷ heat resisting, ❸ wear resisting, and ❹ corrosion resisting, ABSCO Meehanite Castings provide high strength, vibration absorption qualities and best machinability. The properties of each of the 21 different types of ABSCO Meehanite can be depended upon because they are obtained by means of strict metallurgical control of metal structure and accurate regulation of raw materials and foundry practice.

Through Selective Processing, a type of ABSCO Meehanite is available to fit the needs of any of these qualities:

1. *Strength, toughness and high damping capacity.*
2. *Ability to stand shock or strain.*
3. *Free machining qualities.*
4. *Density and solidity for pressure castings.*
5. *Heat and corrosion resistance.*
6. *Freedom from warpage that means constant alignment.*
7. *May be heat-treated for higher tensile strengths and increased resistance to wear.*

If you have a problem involving iron, steel, bronze, or other critical material, ask our technicians to explain how ABSCO Meehanite may help you solve it.

3284

AMERICAN
Brake Shoe
COMPANY

BRAKE SHOE AND CASTINGS DIVISION

230 PARK AVENUE **NEW YORK, N. Y.**

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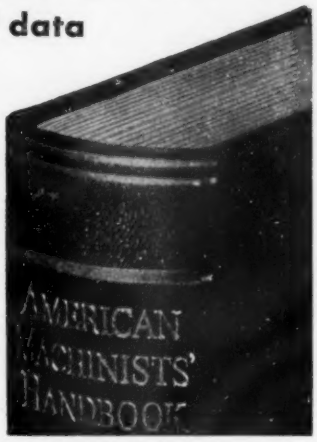
shop methods and data

at your fingertips in this standard and widely-used technical book.



Contains over 1300 pages of latest, dependable data on all branches of machine shop and drafting room practice—2500 illustrations, diagrams, and tables—hundreds of useful facts for any plant.

7th EDITION

Colvin and Stanley's

AMERICAN MACHINISTS' HANDBOOK

1350 pages, 4½ x 7, over 2500 illustrations, diagrams and tables, $4.00

Just where can any worker find as much and so wide a variety of helpful material as is given in this well-planned and well-organized handbook? Just think of being able to find the answer—the *right* answer—to any question—*quickly*—layouts, feeds, speeds, tools, jigs, fixtures, materials, standards, tolerances—a wealth of the most useful information applicable to problems that arise in every type of shop or plant, whatever its size, whatever its special problems.

28 helpful sections

Screw Threads
Pipe and Pipe Threads
Drilling
Reamers and Reaming
Taps and Tapping
Files and Work Benches
Babbitting, Brazing, Soldering and Welding
Gearing
Turning and Boring
Milling Machine Feeds and Speeds
Grinding, Honing and Lapping
Screw Machine Tools, Speeds
Punch Press Tools
Broaches and Broaching
Belts, Nuts and Screws
Measuring and Fitting
Tapers and Dovetails
Shop and Drawing Room Standards
Wire Gages and Stock Weights
Horse-power, Belts and Shafting
Metals and Other Materials
Machine Forgings
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General Reference Tables
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Don't wait till time of acute need to investigate this book. Send for a copy today and see which sections you can use most. *On hand when you need them*, even a few accurate, up-to-date facts from this handy, "pocket-companion" volume will more than repay you its cost.

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Send me Colvin and Stanley's American Machinists' Handbook for 10 days' examination on approval. In 10 days I will send $4.00, plus few cents postage, or return book postpaid. (Postage paid on orders accompanied by remittance.)

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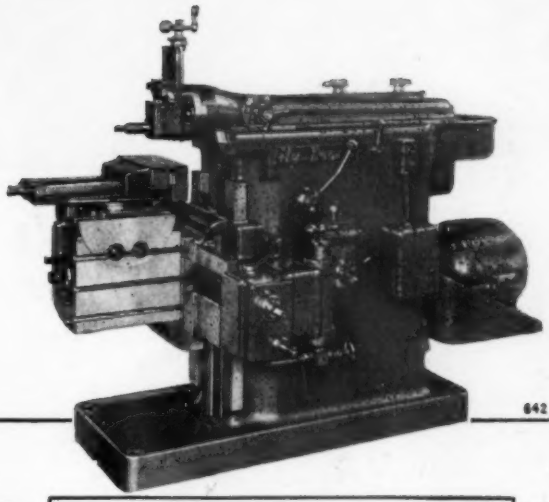
The 12" Hy-Draulic SHAPER

Is Back in the Line



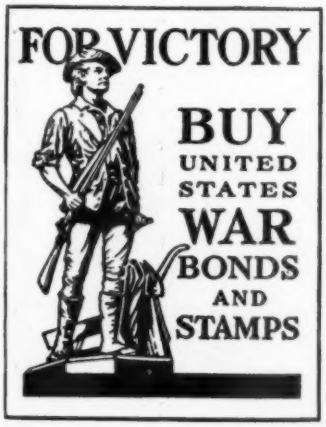
War requirements blacked out all information about 12″ Hy-Draulic High Speed Shapers during many months. *Now the 12″ Hy-Draulic Shaper is back in the line.* Standing orders take the first lot released for civilian use, war requirements remain urgent. Even so, deliveries can be quoted on 12″ Hy-Draulic Shapers ordered now; and we are building all Hy-Draulic Machine Tools as fast as it can be done right.

Note These Advantages

Speed — The 12″ Hy-Draulic Shaper gives you new high speed of set-up, strokes-per-minute, easy handling. It is setting new high production records on lots of current war work.

Easy Operation — Exclusive Hy-Draulic features eliminate hand cranking and use of wrenches in setting ram stroke or position. This adjustment can now be made easily and safely, without stopping the machine. Likewise, any cutting speed or feed rate whatever, in specified wide ranges, can be obtained instantly by light lever movement. Duplicate main controls save time and steps. Universal table, power down-feed to head and other features simplify set-up and operation.

Wide Range — The 12″ Hy-Draulic Shaper does so many different jobs so well, so fast and so easily that it is highly productive everywhere on tool, production or maintenance work.



Openside

Ram Type

SHAPERS

SHAPER-PLANERS

SLOTTERS

PLANERS

Get Details and Action

The various types of Hy-Draulic Machine Tools are indicated above. Get all the details. Send for illustrated Bulletins describing Hy-Draulic advantages, features, performance and specifications. Write for your copies, *today.* On 12″ Hydraulic High Speed Shaper, ask for Bulletin 414.

4303

Hy-Draulic
Reg U S Pat Off

Shapers..Planers..Slotters..Shaper-Planers

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U.S.A.

Quality
THE NICHOLS MILLER
Offers SPEED with Tool Room ACCURACY
Modern precision construction and remarkable adaptability make the Nichols a natural choice for dependable performance.
Insets illustrate FLEXIBILITY. Upper view shows Profile-milling cam slot using template and follower. Lower view is typical horizontal setup, milling clutch teeth using simple indexing fixture.
Moderate price.
Ask for full details!
W. H. NICHOLS & SONS
Waltham Mass.
SOLE DISTRIBUTORS
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50 CHURCH STREET, NEW YORK, N. Y.

FAST ACTION and TREMENDOUS BINDING FORCE

speed production milling and assure accuracy . . . with the

"HARTFORD"

•

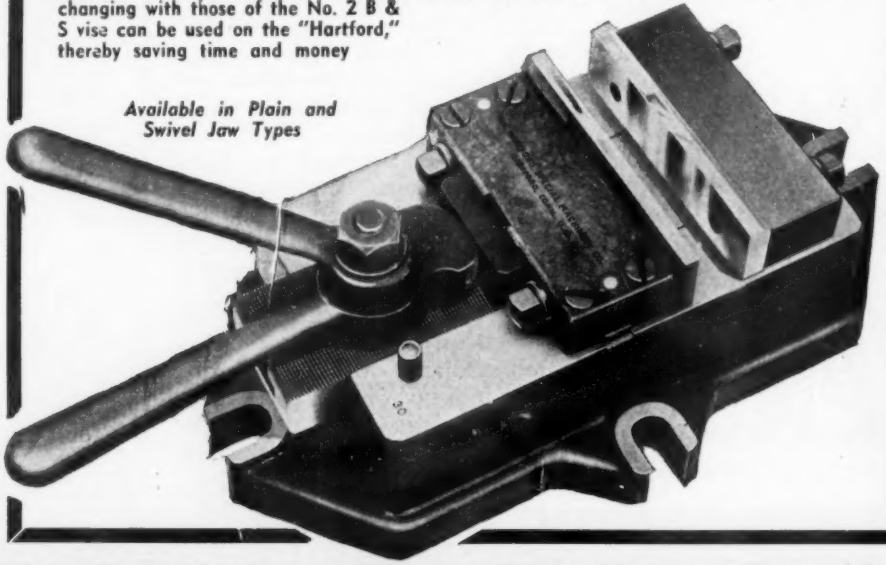
Condensed Specifications

Width of Jaw — 5".
Depth of Jaw — 1 3/16".
Max. opening (Plain Jaw)—2⅝"
Max. opening (Swivel Jaw) — 2¼"
Weight — 40 lbs.
Overall Dimensions — 13" long — 8" wide — 5" high.

All operations are controlled by two levers, the lower cam-faced one providing quick opening and return and the top eccentric lever handle exerting the pressure for holding the work. With a little practice, the operator can manipulate these levers with one hand. Convenience and speed in changing work or removing chips are provided by releasing binding lever and giving the eccentric lever a quarter turn—a simple action that opens the movable jaw about ⅞".

On the "Hartford," the movable jaw occupies the position ordinarily occupied by the solid jaw on conventional vises. This feature contributes to the great strength of the "Hartford" and perfect jaw alignment regardless of where the work is held between the jaws. All parts are interchangeable and can be replaced quickly from stock. False jaws interchanging with those of the No. 2 B & S vise can be used on the "Hartford," thereby saving time and money

Available in Plain and Swivel Jaw Types



THE HARTFORD SPECIAL MACHINERY CO. HARTFORD, CONN.

THE ANSWER to your CUTTER AND TOOL GRINDING PROBLEMS

THE ability of your plant to meet today's production demands depends to a great extent on keeping tools and cutters in A-1 shape. Covel No. 22 Universal Cutter and Tool Grinder is swiftly solving tool and cutter grinding problems in scores of plants—enabling tool rooms to keep pace with production-line demands.

COVEL NO. 22

Universal Cutter and Tool Grinder

Features

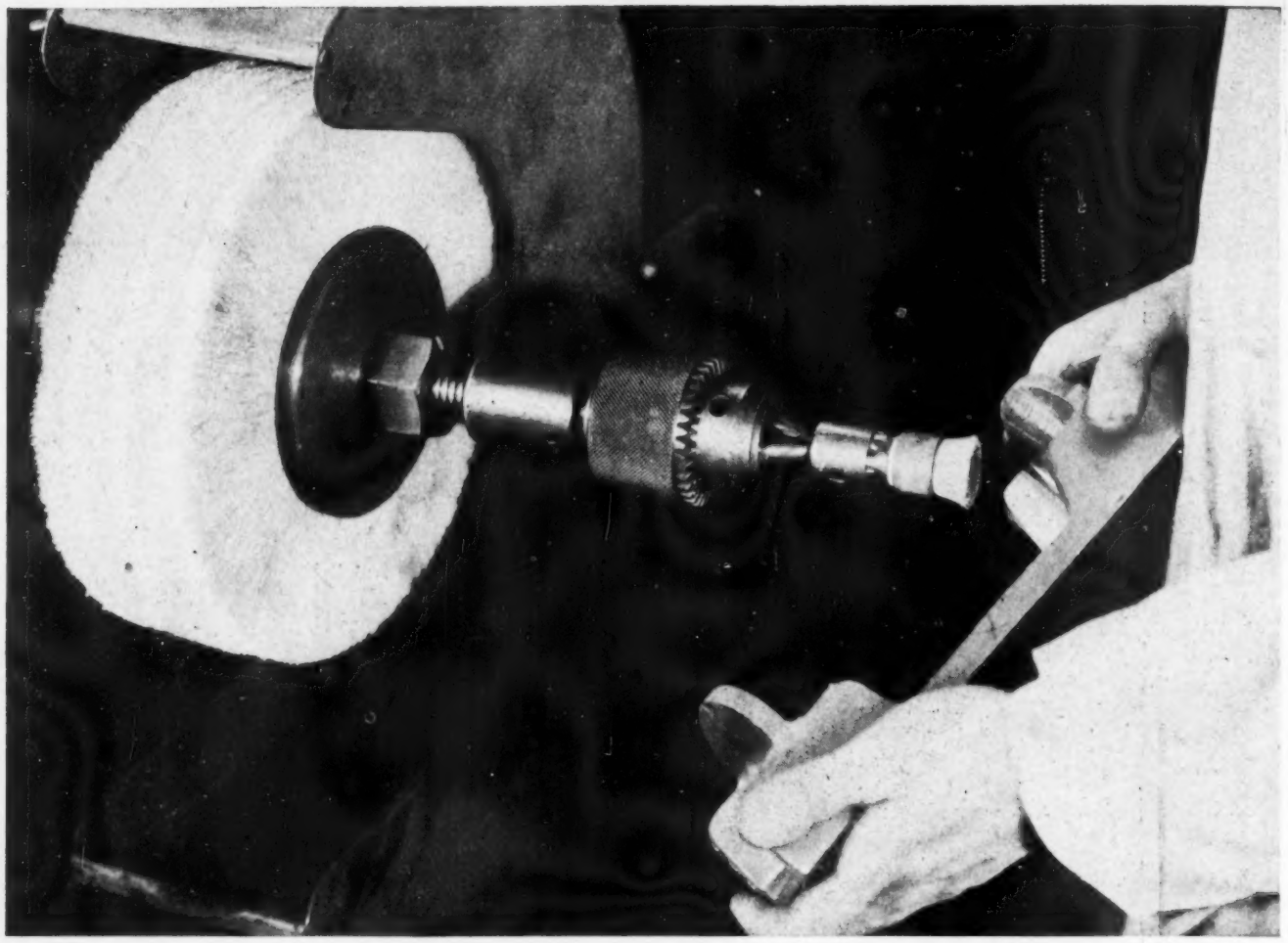
- Heavy, Rugged Box-Type Bed
- All Controls Handy to Operator
- Sensitive Control
- Cartridge-Type Spindle
- Complete Dust Protection
- Quick Alignment of Attachments
- Hardened Anti-friction Ways
- Adjustable Micrometer Stop (Swing-Type)
- Large Assortment of Attachments

For detailed specifications on the fast, flexible Covel No. 22 Universal Cutter and Tool Grinder, write, wire or phone today for Bulletin A-173 and name of nearest dealer.

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.



We bridled a brush to step up horsepower

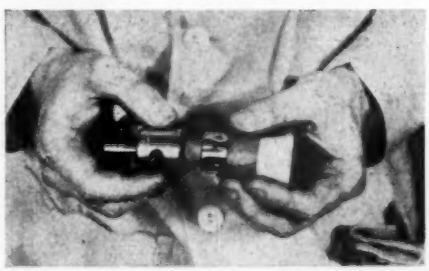
THE deep channels in aircraft engine connecting rods and similar parts are almost impossible for ordinary polishing methods to reach. Yet tool-marks and scratches made in milling out these channels must be removed lest they become points of stress-concentration that under peak loads may cause engine failure.

After every available method had proved insufficiently flexible, the man in charge of all polishing operations for one of the country's largest engine plants recognized that a special brush was needed to get into these deep channels. Osborn was asked to develop such a brush. It is shown here in two views.

Essentially it is a Tampico End Brush with an adjustable bridle to control the flare and stiffness of the special, abrasive-treated tuft. The tuft itself is readily removable from the holder, permitting quick, easy and economical replacement when the fibers become worn.

This Osborn Brush has now been adopted by the aircraft industry generally for fast, effective, inexpensive polishing of hard-to-get-at places in machined parts. Its bridle enables it to be adjusted to the needs of the job at hand, to clean, polish, blend the surface, remove scratches and tool-marks, expose minute defects and by eliminating points of potential stress-concentration, increase the effective power of the engine.

The aircraft industry today is using these brushes by the thousands. The Osborn Brushing Specialist in your district will be glad to show you how these and many other Osborn Brushes can speed and simplify your production for war, and lower the cost of products of peace. *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland, Ohio.*



Osborn Brushes

WORLD'S LARGEST MANUFACTURER OF BRUSHES FOR INDUSTRY

WEAPONS FOR PRODUCTION...

Carborundum Brand Products

IT really does not take much imagination to understand the tremendously important part that abrasive and refractory products by Carborundum are playing in the war effort.

For instance, there isn't a single implement of warfare, from the big guns of the battle wagons to the optical lenses of range finders, that does not require grinding at some stage in its production.

Cranks for Diesel engines as well as all of the extremely accurate parts of the airplane engine, the truck and jeep motors, must be ground. Shells and projectiles just couldn't be produced with speed and accuracy without grinding.

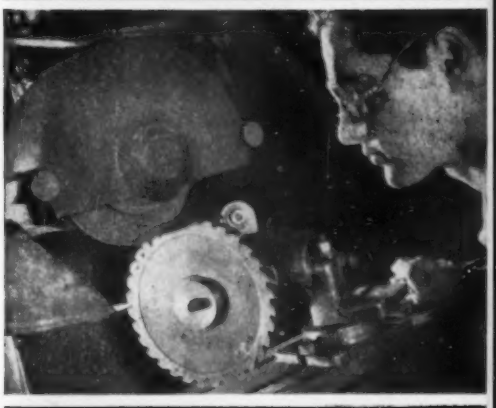
The grinding wheel and grinding methods help to make possible the mass production of tanks, ships, machine guns, rifles and the millions of castings and parts that go to make up the machines of war.

The cutting action of milling cutters, reamers, drills, broaches, hobs, taps, dies and other metal fabricating tools depends upon their being properly, skillfully ground.

The castings and other parts of thousands of machine tools must be ground and miles upon miles of coated abrasive products are necessary in the finishing and polishing of all types of metals.

Super refractory products by Carborundum are also doing their part in making possible the more efficient operation of heat treating, ceramic and boiler furnaces and also hundreds of chemical and metallurgical processes.

These products are "Weapons for Production". Use them wisely to conserve strategic materials and thus hasten the Day of Victory.



CARBORUNDUM BRAND ABRASIVE PRODUCTS

REFRACTORY CARBORUNDUM PRODUCTS

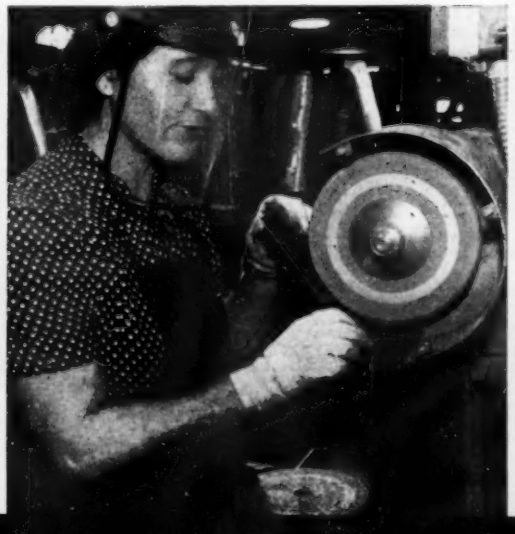
THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

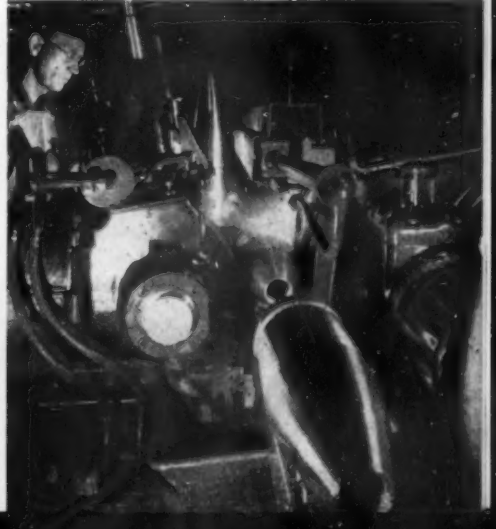
REG. U. S. PAT. OFF.

MANUFACTURERS OF GRINDING WHEELS, COATED ABRASIVES, SUPER REFRACTORIES, HEATING ELEMENTS

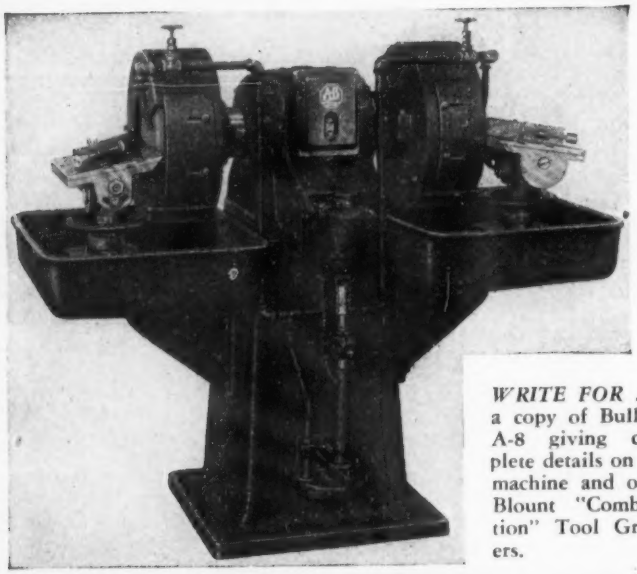
Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)





MODEL TC WET GRINDER "Blount" FOR COOLER, CLEANER, FASTER AND MORE ACCURATE TOOL GRINDING



WRITE FOR . . . a copy of Bulletin A-8 giving complete details on this machine and other Blount "Combination" Tool Grinders.

Today's demands for faster, precision production can be met by the proper conditioning of tools assured by this "BLOUNT" Tool Grinder.

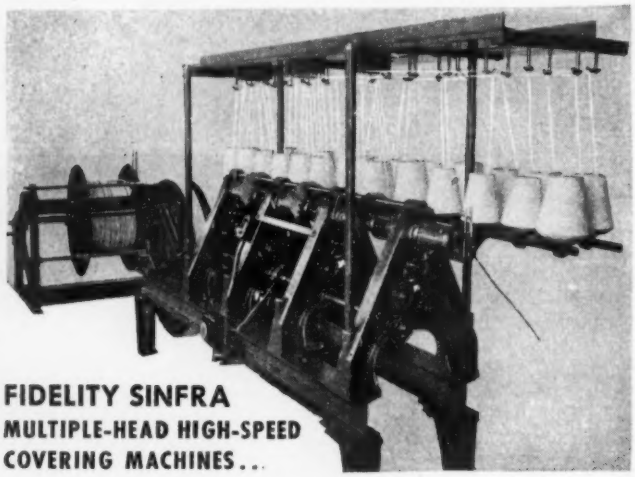
Equipped with adjustable graduated tables, the Model TC will grind all possible angles and clearances on tools.

Features include fully enclosed ball bearing motor; collant tank of ample capacity and easily removable sludge pan in column; vertical motor-driven centrifugal coolant pump; heavy, quickly adjustable guards.

Condensed Specifications

Base of column: 23" x 24"
Base to center of spindle: 37½"
Pan: 6" deep x 27½" wide
Table top: 9½" x 11½"
Adjustable table tops: hardened and ground and equipped with protector guide.
Motor: 3 HP.; 1200 RPM; all voltages
Wheels: cup 14" x 4" x 11"

J. G. BLOUNT COMPANY *Everett, Mass., U.S.A.*



FIDELITY SINFRA
MULTIPLE-HEAD HIGH-SPEED COVERING MACHINES . .

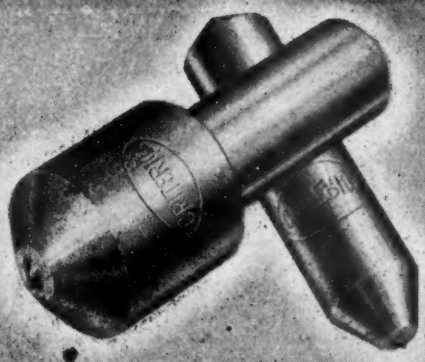
Knits two or three cotton coverings on bare wire up to #6 gauge—also flat or shaped, continuous-strip material, 1200 to 1500 feet per hour. Saves rubber since cotton coverings, impregnated, form excellent insulation. Straightening rollers operate horizontally and vertically. Each head knits one cover. 20" or 36" capstan take-off—separate haul-off reel stand, 40" O.D., with traverse mechanism, 1000 lb. capacity.

Other advantages include: automatic electric stop motion on each yarn; improved knitting head and needle design; knits direct from large cones; quiet operation reduces operator fatigue.

Available in double- and triple-head types. Write for Bulletin.

FIDELITY MACHINE COMPANY
3908-18 FRANKFORD AVE., PHILADELPHIA, PA.

CRITERION *Diamond* TOOLS



For **STEADY PRODUCTION**

Dependable diamond tools are vital in present production schedules. Every day more users are turning to Criterion Diamond Tools for the kind of service which they must have. Quality of diamonds used plus a unique method of setting assures extreme rigidity and extra tool life. Special tools made to order following blueprints or specifications. Sharp-pointed, selected thread grinding tools. Order direct. Request free literature.

CRITERION MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

A flexible machine that is the last word in simplicity of operation

HI-SPEED
HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"...Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2¼"	2¾"	2½"	2⅝"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	16 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia	12" Dia	16" Dia	20" Dia
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44" x 60"	60" x 80"	60" x 80"	60" x 108"
Overall Height	11'6"	15'3"	18'3"	23'8"

ARMY E NAVY

Over our factory flies the ARMY-NAVY "E"—awarded for excellence in the production of machinery and tools vitally needed to win the war.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

For SURFACE GRINDING

This 846 K-1 Dayton Grinding Wheel is Doing a Whale of a Job for Hundreds of Users.

Example No. 1. Surfacing mild steel on hydraulic grinder—giving maximum stock removal with a minimum of wheel wear.

Example No. 2. Precision grinding of hardened steel parts—with high production efficiency and giving excellent finish.

Example No. 3. Many users of this wheel have found it ideal for surfacing varied materials, saving time usually required to change wheels.

If you have a problem in surfacing or any other grinding that you haven't solved to your complete satisfaction, we may have the answer.

Write, wire, or phone—giving us an outline of your problem—and one of our experienced engineers will serve you promptly and efficiently. We may have what you need in stock.

Dayton Grinding Wheels

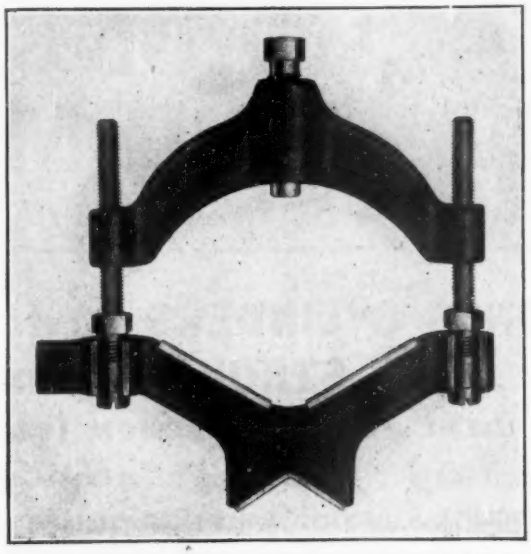
Simonds Worden White Company

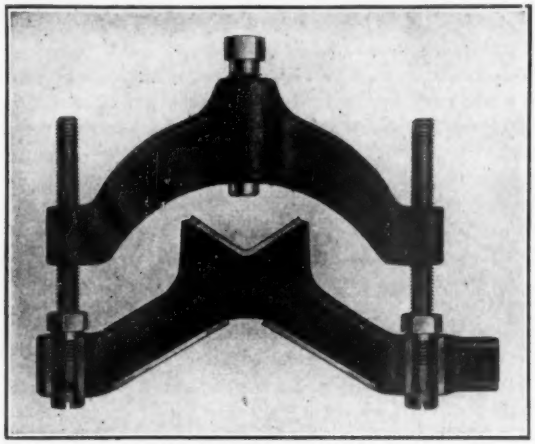
712 Negley Place, Dayton, Ohio

BARTER-RITCO

Grinding Machine Dog

RUGGED • LONG-LIVED • ADAPTABLE





A versatile and popular tool for over thirty years, specially designed for cylindrical grinders. Its drop forged jaws are exceptionally strong; all adjusting screws and nuts have cut threads hardened to resist wear. Reversible jaw and side adjusting screws give each size a wide capacity. Rust proofed.

Five sizes, with capacities as follows:

1"	—	from	1/4"	to	1"	round, inclusive
1½"	—	from	7/8"	to	1½"	round, inclusive
2½"	—	from	1½"	to	2½"	round, inclusive
4"	—	from	1¾"	to	4"	round, inclusive
6"	—	from	3"	to	6"	round, inclusive

Write for descriptive literature.

RHODE ISLAND TOOL CO.

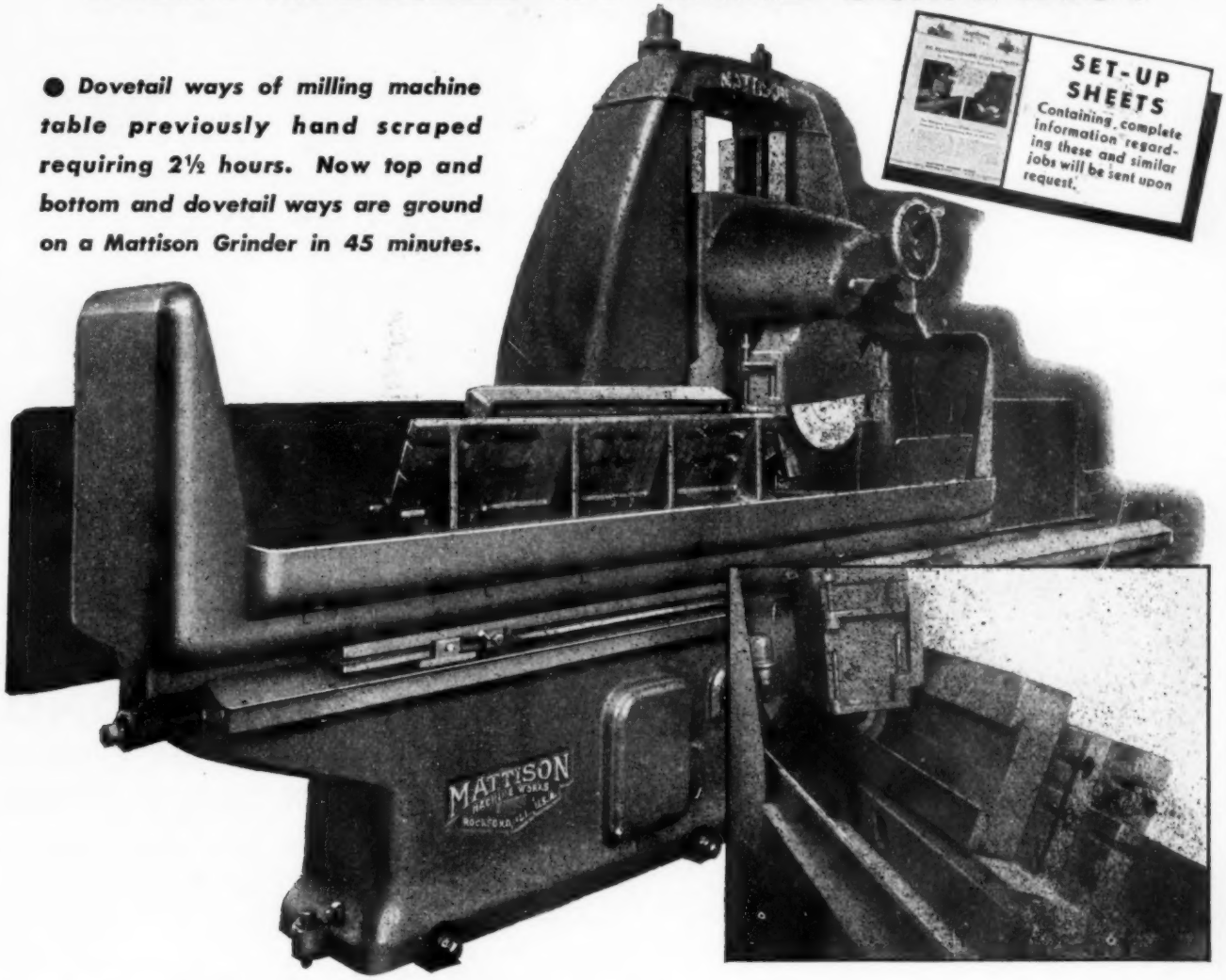
148 WEST RIVER ST., PROVIDENCE, R. I.

Serving American Industry since 1834

Jobbers wanted — Write us for proposition.

Dovetail Ways GROUND
ON MATTISON GRINDER IN 70% LESS TIME THAN REQUIRED BY HAND SCRAPING!

● ***Dovetail ways of milling machine table previously hand scraped requiring 2½ hours. Now top and bottom and dovetail ways are ground on a Mattison Grinder in 45 minutes.***



SET-UP SHEETS
Containing complete information regarding these and similar jobs will be sent upon request.

● The illustration shows a Mattison High-Powered Precision Surface Grinder in the plant of Kent-Owens Machine Company grinding the dovetail ways of a milling machine table to precise accuracy and a very fine finish. An angle truing device permits truing both angles of wheel for grinding dovetail ways. The special holding fixture is used for holding table in position.

Previously it required 2½ hours to scrape the dovetail ways. Now, the Mattison Grinder not only grinds the dovetail ways, but the top and bottom of table, as well, in 45 minutes. The dovetail ways are ground to within .0003″ of parallelism.

The above application is another example of how costs can be reduced through the use of a Mattison Grinder. It also shows the possibilities for grinding tables—slides saddles — heads — turrets, etc., having dovetail ways.

For those of you who have work of this kind, we suggest sending us drawings for an economical solution. If you would like free copies of our set-up sheets, showing other jobs of way grinding, drop us a line.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

Here's Why TRU-LINE DIAMOND TOOLS SAVE MONEY— SPEED PRODUCTION!

Designed for straight, profile and step dressing operations, TRU-LINE TOOLS are engineered to the job by craftsmen whose many years of experience have taught them the proper application of industrial diamonds and diamond tools to all types of production jobs. TRU-LINE TOOLS embody these money-saving and time-saving features:

1 NO TURNING—diamonds contact wheel at right angles to wheel axis . . . no turning of tool necessary . . . patented blade does not glaze, is always free cutting.

2 OVERLAPPING ROWS—diamonds contacting wheel cut in same line . . . rows overlap—as one row is used another row is in cutting position . . . a continuous cutting surface is thus obtained.

3 THIN BLADE—dissipates heat rapidly . . . diamonds held securely by chemical reaction between diamonds and patented matrix alloy until entirely used up.

4 SELECTED DIAMONDS—the machine, wheel grain texture, wheel hardness and characteristics of piece to be worked are considered in selecting diamonds for TRU-LINE TOOLS . . . smaller diamonds cut tool costs materially.

★ *SEND FOR THIS FREE BOOK TODAY!*

Learn of the many other money-saving and time-saving features of TRU-LINE TOOLS. This new book gives complete details with prices. Send for it today!

WHEEL TRUEING TOOL COMPANY INCORPORATED

3200 W. DAVISON DETROIT 6, MICH.

STANDARD

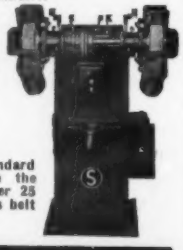
Multiple Grinders

A MULTIPLE SPEED GRINDER FOR MULTIPLE ECONOMY. Peripheral speed is maintained, thus increasing production. Wheelstubs from larger wheels, formerly discarded, may be transferred to this Grinder.

Outstanding Advantages Include:

Safety type hinge door exhaust guards, adjustable to wheel wear. Interlocking arrangement prevents over-speeding of grinding wheels. Push button starting. Available in wheel size. 10" to 30" diameter. Suitable for Vitrified and Resinoid bond wheels.

Adapted for Resinoid or Vitrified Wheels



This Multi-Speed Standard Grinder operates with the same efficiency at either 25 or 60 cycles through its belt drive.

Write for Catalog No. 43. Prices, specify voltage, phase, cycles.

The STANDARD ELECTRICAL TOOL Co.

CINCINNATI • OHIO

2490 River Road

DESMOND

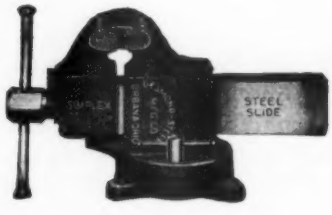
GRINDING WHEEL DRESSERS & CUTTERS

We manufacture a complete line of wheel truing tools and can supply the proper dresser for each of your grinding wheels.

SIMPLEX

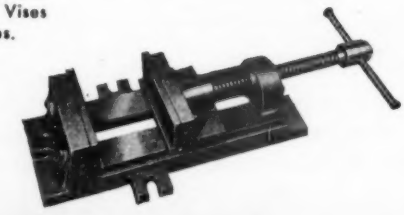
Steel Slide

VISES



A full line of Machinists, Welders, Filers, Production and Drill Press & Milling Machine Vises with solid steel slides.

Write for copy of catalog "A" and name of your nearest dealer who can supply you.



ARMY (E) NAVY

THE DESMOND-STEPHAN MFG. CO.

URBANA • OHIO

THE ABRASIVE INTERNAL GRINDER No. IG

Available for Immediate Delivery

Originally designed for high production work grinding cartridge dies and similar small parts, the Abrasive Internal Grinder No. IG offers unusual flexibility and handles a wide variety of production and toolroom grinding jobs. Heavier in weight than most bench-type grinders, the No. IG is exceptionally rugged and accurate. Work spindle, of machine tool construction, mounted on super-precision ball bearings, is carefully sealed against abrasive grit. Diamond wheel dresser assures accuracy of hole size.

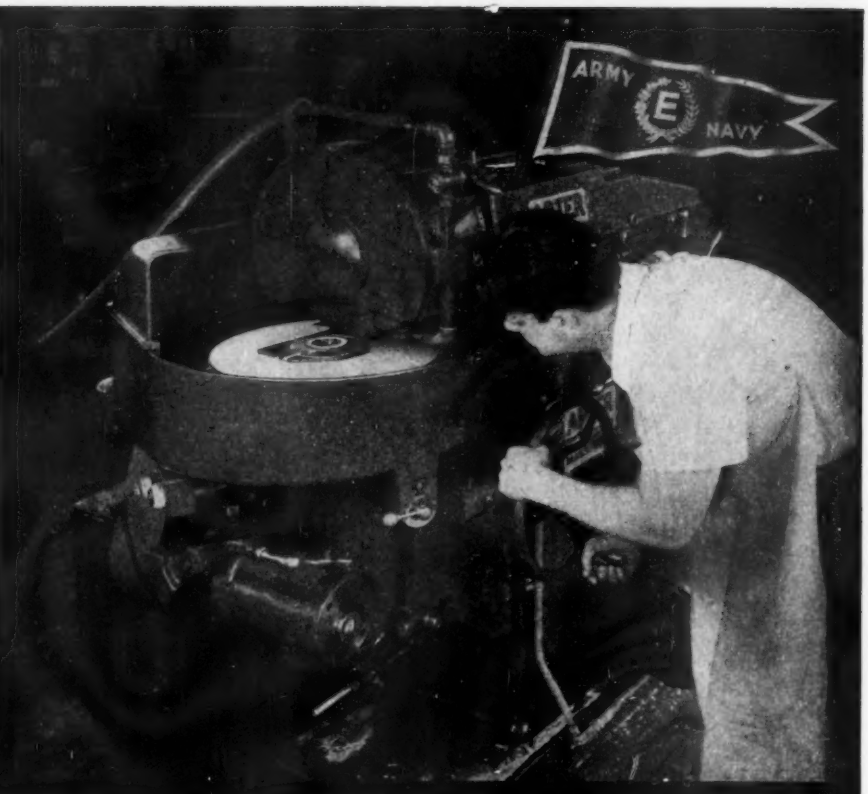
Write for descriptive literature illustrating the unusual versatility and range of this machine.

ABRASIVE MACHINE TOOL CO., EAST PROVIDENCE, R. I.

War-learned efficiency will create new competition, new and better products in the new world of the future when Victory is ours. New skills and new techniques are being developed.

In the new world of the future, precision-grinding — in quantity — will play an increasingly important part.

The makers of ARTER ROTARY SURFACE GRINDERS are looking into that future confident that the Arter developments in rotary surface grinding will help you in your precision production plans for the peacetime future of America.

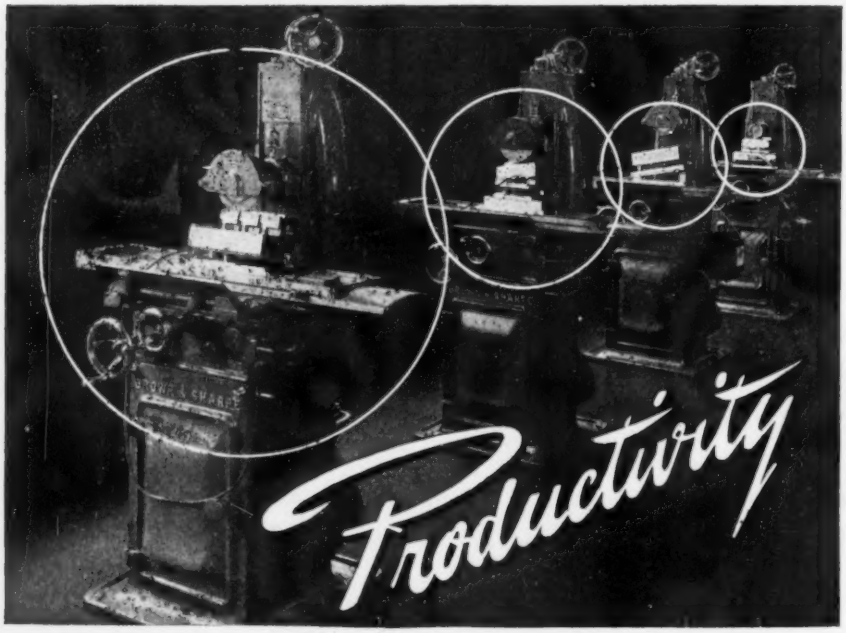


ARTER

ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.

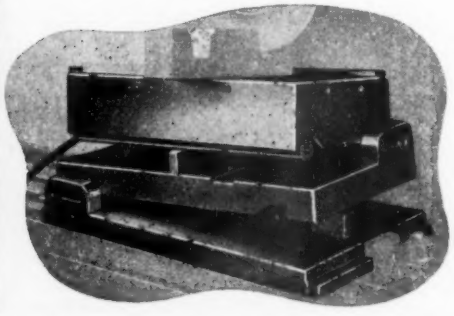
ANGULAR GRINDING



A Magna-Sine should be available for every machine on which an average value of angular grinding is done.

The Magna-Sine saves valuable minutes — or possibly an hour or more — when any individual angular set-up is required. Multiplying this saving of time by the number of jobs on various grinders, you find the means to get many additional PRODUCTIVE HOURS from your equipment. No other chuck or similar device offers the precision accuracy of the Magna-Sine in grinding work requiring either single or compound angles.

WRITE FOR FULL INFORMATION
The MAGNA-SINE



INCREASED MANY TIMES OVER WITH MAGNA-SINES

ROBBINS ENGINEERING COMPANY

318 MIDLAND AVENUE • DETROIT 3, MICHIGAN

Test billets for gun barrels must *be ground*—

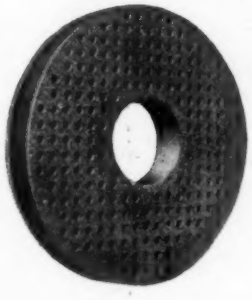
and this 36" GARDNER GRINDER does it—*efficiently!*

The circular pieces at the bottom of the above illustrations are test slugs, or billets, cut from gun barrels, which must be ground on one face to a good finish, for etching in a steel analysis. It's a tough grinding job because of the large area involved in many of the billets.

The Gardner No. 230-36" Disc Grinder seen here, handles billets, ranging from 2¾" up to 7⅝" O.D., and removes about .010" to .015" stock. A quick-clamping fixture on a hand-operated lever table, is used. PRODUCTION: 15 to 20 per hour on an average size; say, 6¾" diameter.

Investigate GARDNER-GRINDING for Your TOUGH jobs—Ask for Bulletin 200B.

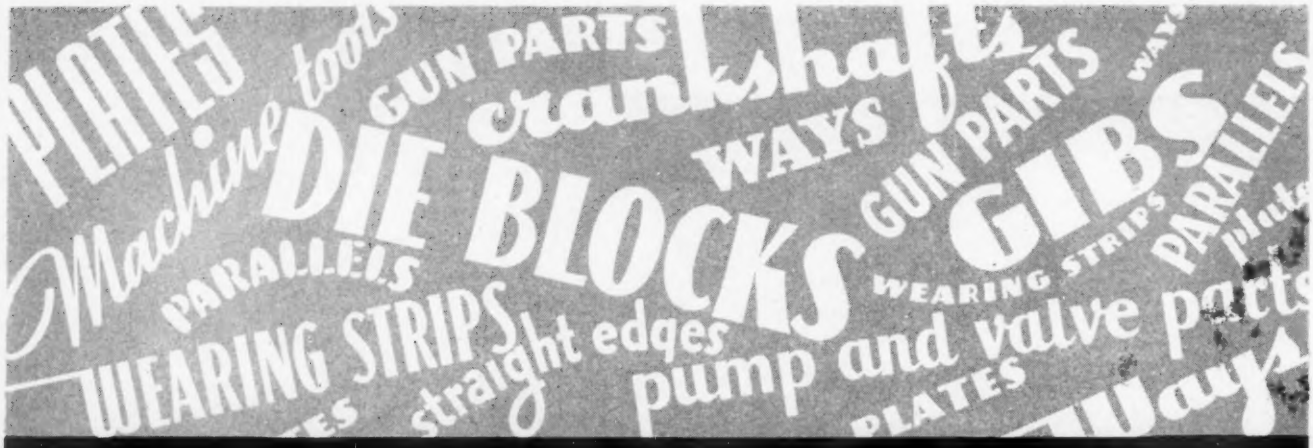
Use Modern GARDNER WIRE-LOKT Abrasive Discs on Your Disc Grinders!



GARDNER-GRIND YOUR *Flat* SURFACES

GARDNER MACHINE COMPANY

410 East Gardner Street . . . . Beloit, Wisconsin, U.S.A.



HANDLING A WIDE RANGE OF WORK WITH HILL HYDRAULIC SURFACE GRINDERS

★ Most HILL Precision Surface Grinders are purchased for a specific application, but all users of HILL Grinders find they are also ideally suited for a multitude of other operations.

It is this versatility that has resulted in HILL *"Open Side"* Hydraulic Grinders superseding other methods of finishing. The HILL grinder features massive construction, wide speed variation, 100% hydraulic drive, simplified controls, ample motor power for rapidly removing stock, and accuracy maintained within requirements. HILL Hydraulic Surface Grinders should have a definite place in the post-war planning of your revamped shop efficiency. HILL Grinders are built in both Horizontal spindle and Vertical spindle types in a wide range of sizes. Bulletin H-V-8 gives complete details.

18" x 18" x 120" HILL *"Open Side"* Horizontal Spindle Hydraulic Surface Grinder, with magnetic chuck holding work in place.

The

HILL ACME CO.

6400 BREAKWATER AVE. • CLEVELAND, OHIO

"HOW IS POR-OS-WAY DOING ON HIGH-SPEED STEEL CUTTERS?"

Dear Charlie:
You wanted to know how Por-os-way's doing on high-speed steel cutters. So here goes from the [redacted] plant. These cutters are for finning airplane cylinder barrels. Production is up 66 2/3%. no more burning and no rejects. The boys are sure fussy about their work and sold on Por-os-way. Can you blame 'em?
Your roving reporter,
"Vic"

READ THIS, WRITES
POR-OS-WAY'S
WAR PLANT REPORTER

THE RECORD	POR-OS-WAY WHEEL	FORMER WHEEL
Production per man per hour	5 sets (20 pcs.)	3 sets (12 pcs.)
Pieces per dressing	8 to 12	3
Wheel life	8 hours	6 hours
Stock to be removed	.010"—.018"	Same
Depth of cut per pass	.003"	.001"
Rejects	None	0.5 to 1%
Operations eliminated	Cutting shoulder	
Production Increase	66⅔%	
Remarks: Former wheel burned work. Por-os-way grinds cool, holds corner.		

THE JOB:
Grinding sets of Huther high-speed steel cutters for finning airplane cylinder barrels on a universal tool and cutter grinder.

THE WHEEL: Por-os-way 7"x ½"x 1¼" 9A60HV2.

All facts and figures given are taken from an actual field survey made by a Por-os-way correspondent.

Write for complete booklet "Facts About Por-os-way". The address is 430 Wheatland Street, Phoenixville, Pennsylvania.

2 TO 5 TIMES MORE WAR PRODUCTION PER MAN PER MACHINE

POR-OS-WAY*
a new RADIAC* PRODUCT

A. P. DE SANNO & SON, INC.
NEW YORK, CHICAGO, PITTSBURGH, CLEVELAND, DETROIT, LOS ANGELES

PHOENIXVILLE, PENNA.
Western Gateway to VALLEY FORGE

*T. M. Reg. U. S. Pat. Off.

COPYRIGHT, 1943, A. P. de Sanno & Son, Inc.

THE EXECUTIVE WHO STOPS TO THINK . . .

Knows that "10% for War Bonds isn't enough these days"

Workers' Living Costs going up . . . and Income and Victory Tax now deducted at source for thousands of workers . . .

Check! You're perfectly right . . . but all these burdens are more than balanced by *much higher* FAMILY INCOMES *for most of your workers!*

Millions of new workers have entered the picture. Millions of women who never worked before. Millions of others who never began to earn what they are getting today!

A 10% Pay-Roll Allotment for War Bonds from the wages of the family bread-winner is one thing—*a 10% Pay-Roll Allotment from each of several workers in the same family is quite another matter!* Why, in many such cases, it could well be jacked up to 30%—50% or even more of the family's *new* money!

That's why the Treasury Department now urges you to revise your War Bond *thinking*—and your War Bond *selling*—on the basis of *family* incomes. The current War Bond campaign is built around the family unit—and labor-management sales programs should be revised accordingly.

For details get in touch with your local War Savings Staff which will supply you with all necessary material for the proper presentation of the new plan.

Last year's bonds got us started—*this year's bonds are to win!* So let's all raise our sights, and get going. If we all pull together, we'll put it over with a bang!

This space is a contribution to America's all-out war effort by

AMERICAN MACHINIST

you've done your bit

. . . now do your best!

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

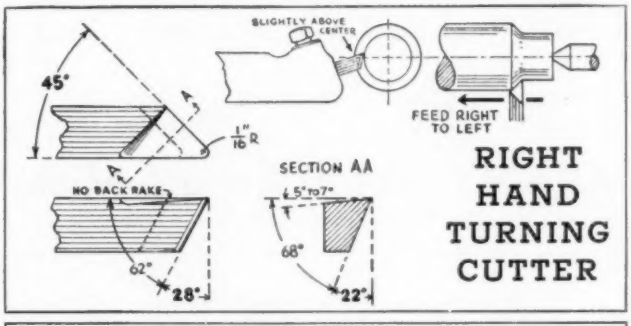
HOW AND WHY

WILLIAMS' TOOLS AID WAR PRODUCTION

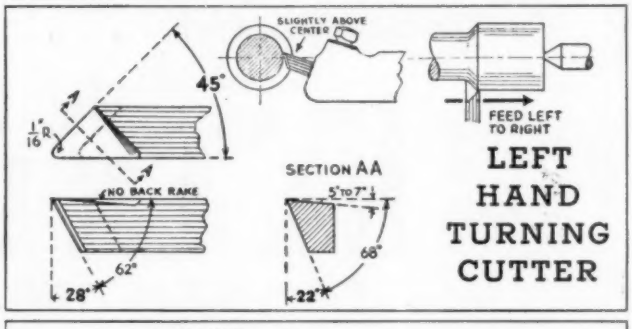
GRINDING CUTTERS FOR WILLIAMS' TOOL HOLDERS

DATA SHEET A, covering Turning, Cutting-Off and Threading Tools for machining cast iron and steel.

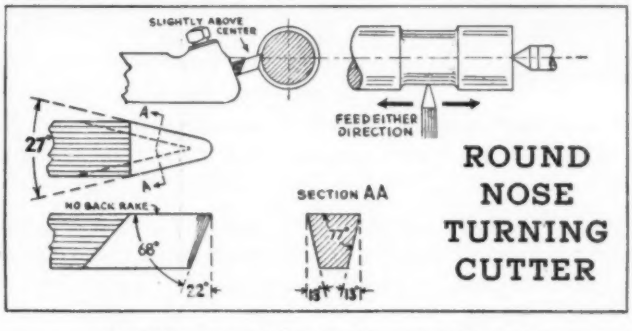
● Since a correctly-ground cutter bit is essential to good lathe work, the following instructions are offered to users of Williams' Tool Holders as representing our recommended practice for general machine work with the high speed steel cutters furnished with Williams' Holders. If, after grinding, cutting edges are honed with an oil stone the bit will cut better and last longer.



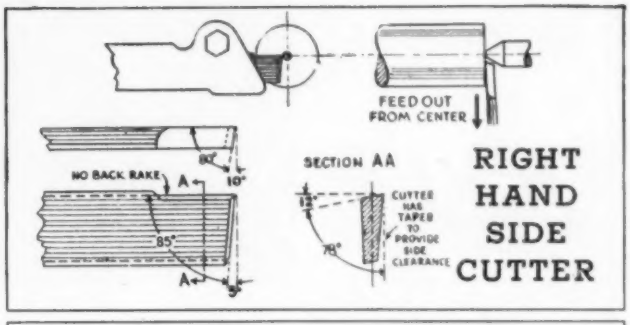
RIGHT HAND TURNING CUTTER



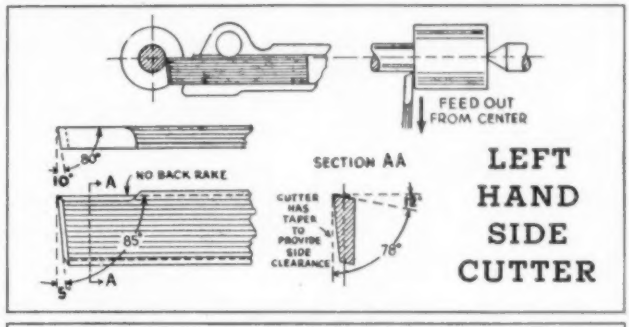
LEFT HAND TURNING CUTTER



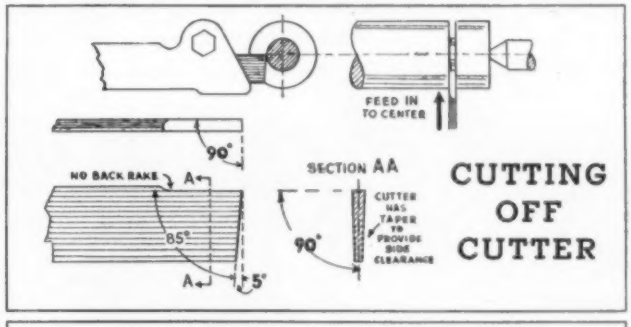
ROUND NOSE TURNING CUTTER



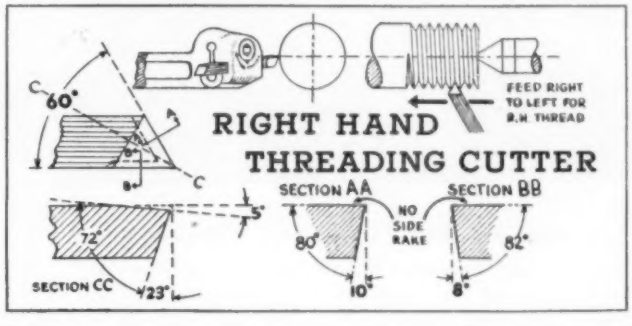
RIGHT HAND SIDE CUTTER



LEFT HAND SIDE CUTTER



CUTTING OFF CUTTER



Additional Data Sheets on the subject of grinding other cutters for Williams' Tool Holders will follow.

Sold by Leading Industrial Distributors Everywhere

J. H. Williams & Co., Buffalo, N. Y.

WILLIAMS
SUPERIOR DROP FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

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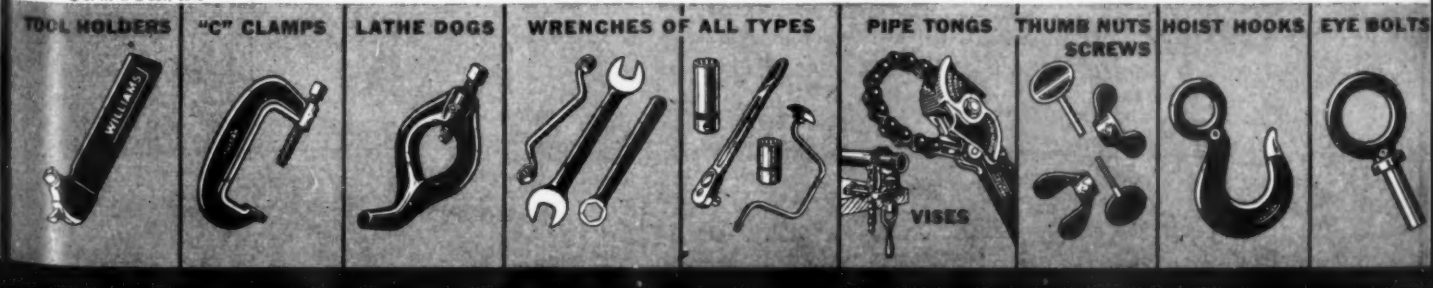
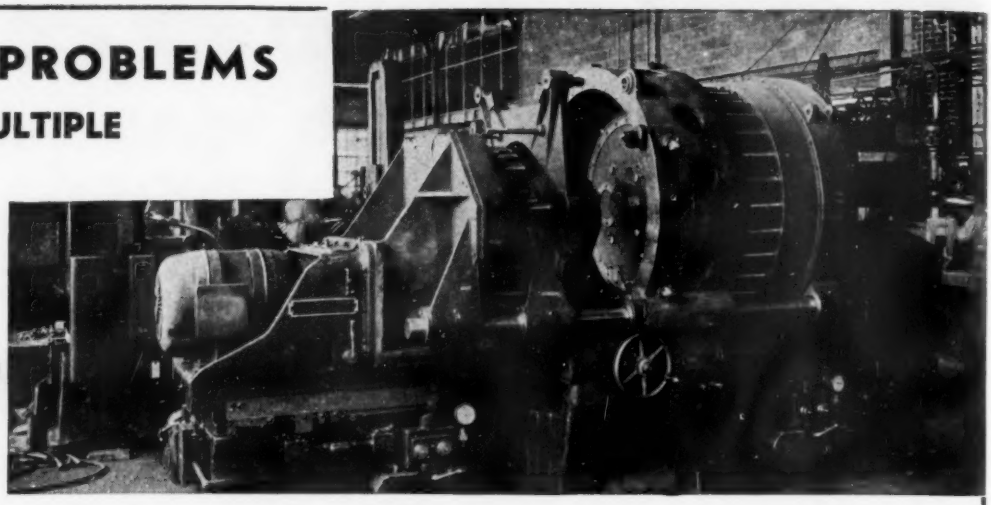


SOLVING PROBLEMS INVOLVING MULTIPLE SPINDLE OPERATIONS A Buhr SPECIALTY

Note This One



Tooling consists of a fixture for clamping an anti-aircraft part of which one side is a bushing plate. Right hand head has 82-spindles, and Left hand head has 38 spindles with a sliding bushing plate for removal of part from fixture.

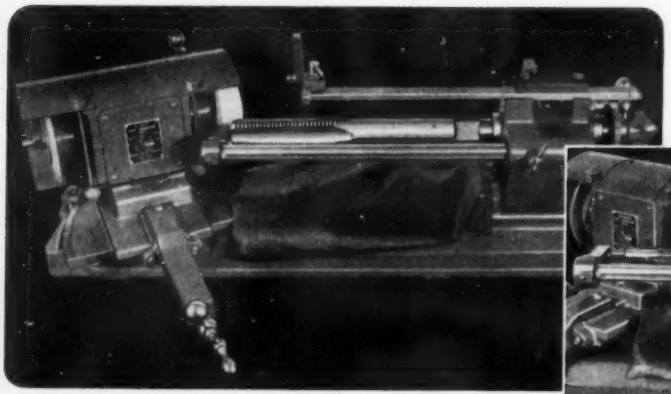
All spindles have vertical adjustment for drill adjustment. An oil pump is provided in each head to insure positive lubrication to all ball bearings in the head.

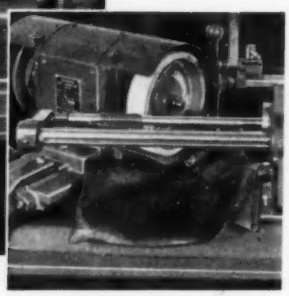
These heads are direct motor driven and mounted on ways and are moved in and out by hydraulic cylinders.

If you have a production problem, let Buhr engineers help you.

BUHR MACHINE TOOL COMPANY, Ann Arbor, Mich.

Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment





Announcing . . .

THE NEW No. 2 BLAKE TAP GRINDER

The new No. 2 Blake Tap Grinder will sharpen the chamfer on taps from No. 0 to 2 inches, and up to 14 inches long. Except for increased capacity, the No. 2 retains all the proven construction features of the No. 1 machine. The longer segment under the wheel head slide allows the head to swivel to the back of the work. Thus shell type taps, or taps with long pilots, clear the wheel head, yet are rigidly supported as shown in photo at right. Conventional taps are sharpened in the usual way as shown at the left.

Change gears are provided for sharpening 2, 3, 4, 5, 6, 8 or 10 flutes, either right- or left-hand.

Complete details on this money making machine will be found in the new Bulletin No. 5—*send for your copy today.*

—FOR DETAILS MAIL THE COUPON—

Please send Bulletin No. 5 covering the No. 1 and No. 2 Blake Grinders.

Name ..... *Title* .....

Company .....

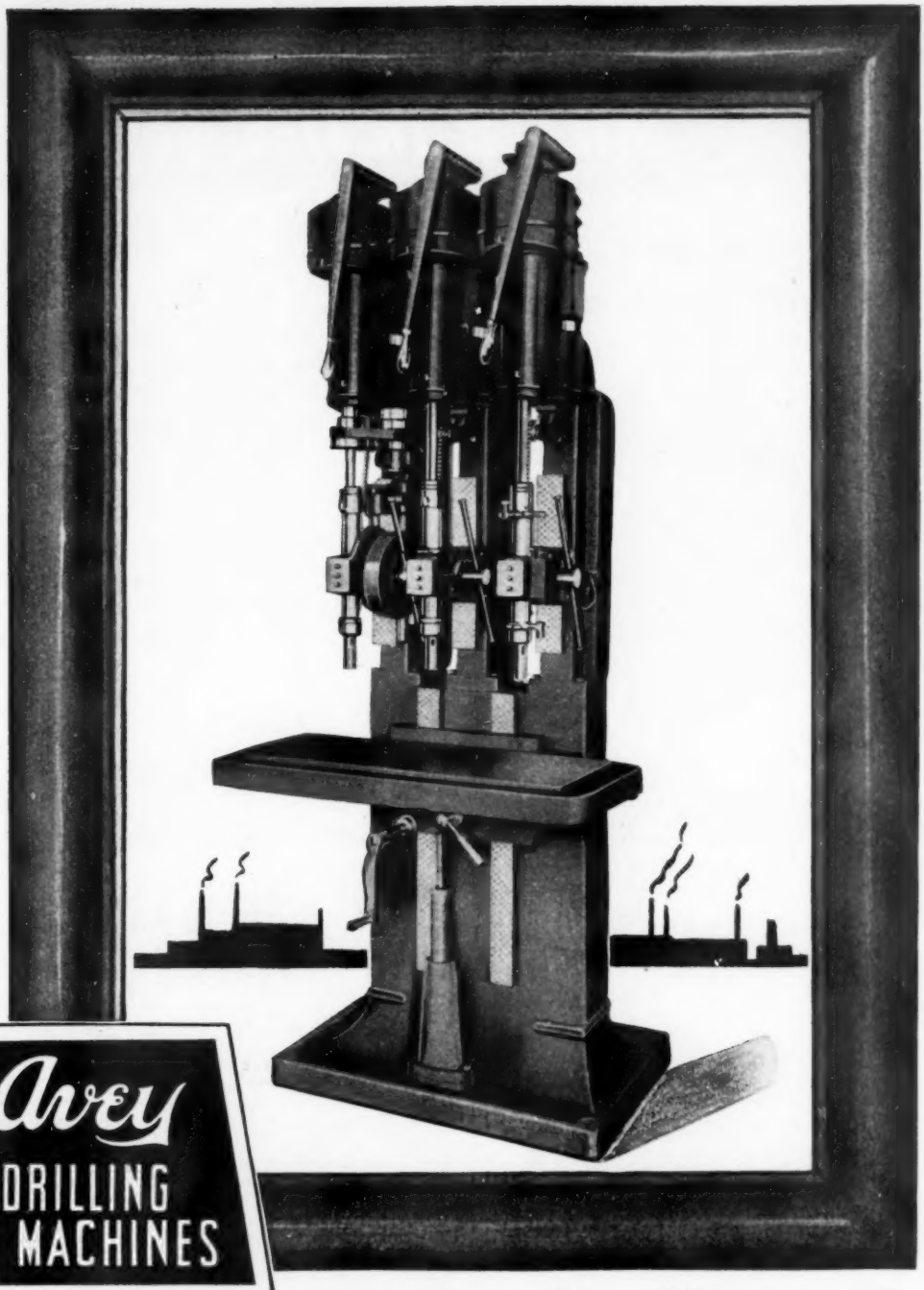
Street .....

City ..... *State* .....

A.M.

EDWARD BLAKE COMPANY
274 COMMONWEALTH AVE., NEWTON CENTRE, MASS.

BLAKE TAP GRINDERS — FILTAIRE PORTABLE DUST COLLECTORS — AMERICAN TOOL HOLDERS — BLACK DIAMOND PRECISION DRILL GRINDERS — L & D HIGH SPEED DRILL PRESSES



Avey
DRILLING
MACHINES

. . . In the Picture for 1943

Make sure it is in your production line for 1943. Avey Drilling Machines give longer operating hours, smoother performance and lower maintenance. They'll do your war job now, your peace job later. We illustrate the Avey Type MA-6 in No. 2 size *(Capacity in cast iron, 7/8")*. No. 3 size *(Capacity in cast iron, 1 1/4")*. One to six spindle units, either size. Six speed machine, two speed motor, three mechanical changes through gearing, 8 to 1 speed range. Push button control. MA-6 illustrated, has three spindles, the Aveymatic Feed, Hand Feed and Tapper.

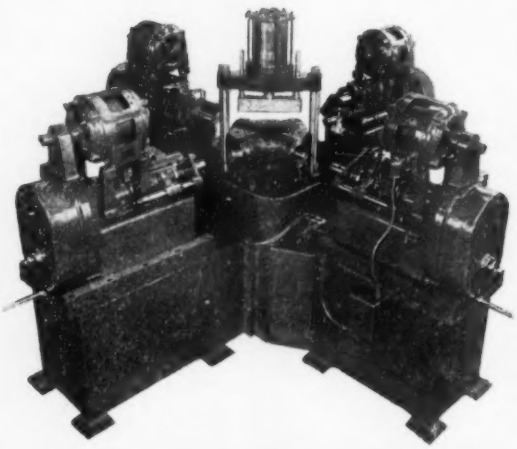
AVEY DRILLING MACHINE CO.
CINCINNATI, OHIO U. S. A.

CINCINNATI · OHIO

Avey DRILLING MACHINES

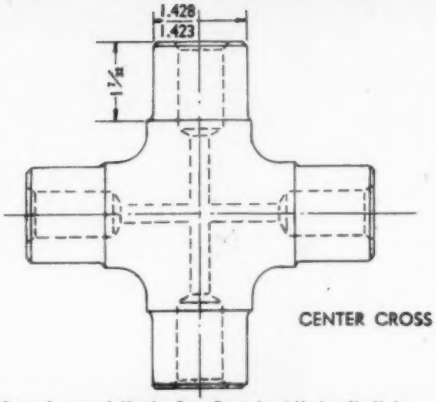
FOUR UNIVERSAL JOINT ARMS
MILLED in 11½ Seconds

HOEFER BUILDS 4-way, 5 h. p. Units
Complete with base and fixture



SAE 4620 Forging used for center crosses for all sizes of motor propelled war machines required hollow milling operation of 1-7/16" diameter. Speed 50' per minute. Feed .050" per revolution. Travel 1¼".

Special purpose machine for this job featured central hydraulic controls to move heads simultaneously.



CENTER CROSS

One of several Hoefer Self-Contained Hydraulic Units, mounted on a suitable inexpensive base or on another machine, make up a special high production machine at a fraction of the cost for specially designed equipment.

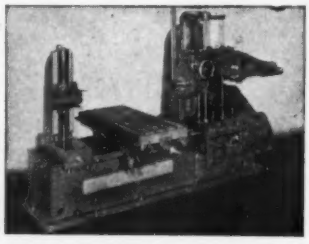
Possibly our experience can be of value to you in considering your present production problems and in planning for the future.

Hoefer's Whole Business is Holes

HOEFER MFG. CO. *Freeport, Ill.*

UNIVERSAL *Horizontal Boring Machine*
The only TRIWAY *Boring Machine Built*

Made in 3" and 4" spindle sizes. Write for complete, detailed specifications.



Standard Universal 3" Spindle Machine

UNIVERSAL BORING MACHINE CO.
Hudson, Mass., U. S. A.

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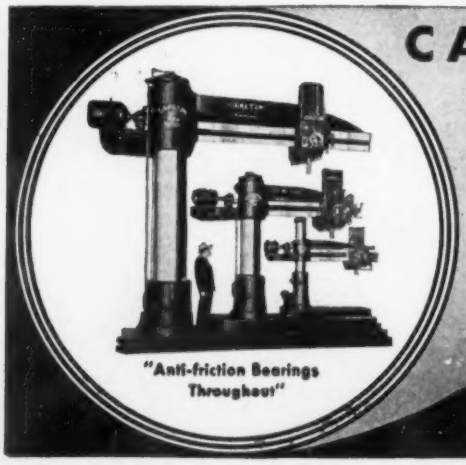
HONERS . . . DRILLERS
Write Today for Catalog A
BARNES DRILL CO.
830 CHESTNUT STREET ROCKFORD, ILLINOIS

LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS · CRANK SHAFTS

Drilling and Tapping Machines
(Automatic and Semi-Automatic)
LELAND GIFFORD CO.
WORCESTER, MASS.



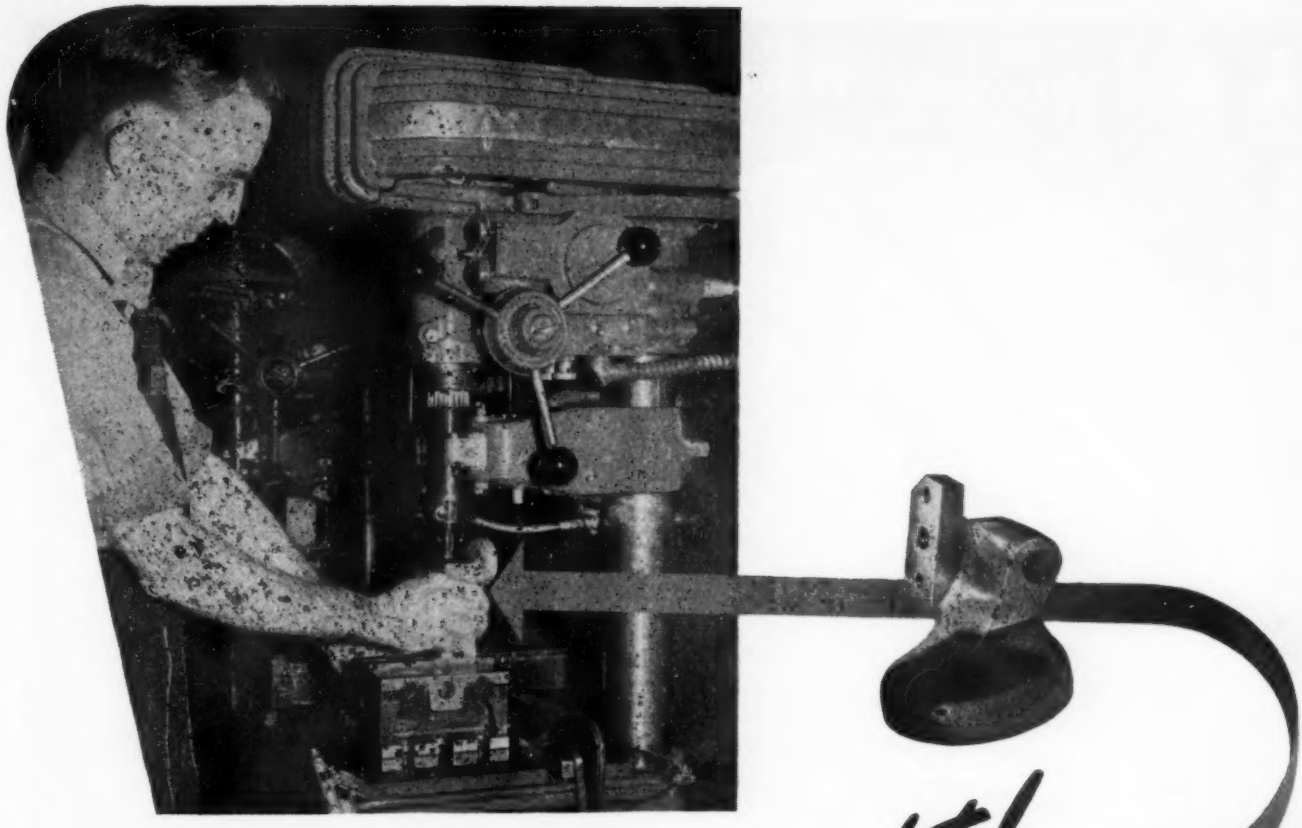
"Anti-friction Bearings Throughout"

CARLTON RADIAL DRILL

FEATURES — 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The **CARLTON**
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY



. . . it's got to be right!

★ ★ ★ THERE'S no time to be lost because of rejected parts. A delay may lose a life, or a battle. Chance cannot be taken where safety depends upon the precision of mating threads.....That's why manufacturers of parts and engines for every fighting plane, every bomber, on our far flung battle fronts use Bakewell Precision Tapping Machines. The exclusive leading-on mechanism of the Bakewell assures even a Class 5 thread fit in any material, with one pass, without rejects. The Bakewell lead screw hobs its own pitch onto electrically operated brass guide fingers which engage the lead screw as the tap cuts. Play and backlash are eliminated. Sizes of holes tapped in any material are governed according to tap pitch diameter. Time, labor, materials are saved .....The war doesn't have to wait for Bakewell tapped holes.

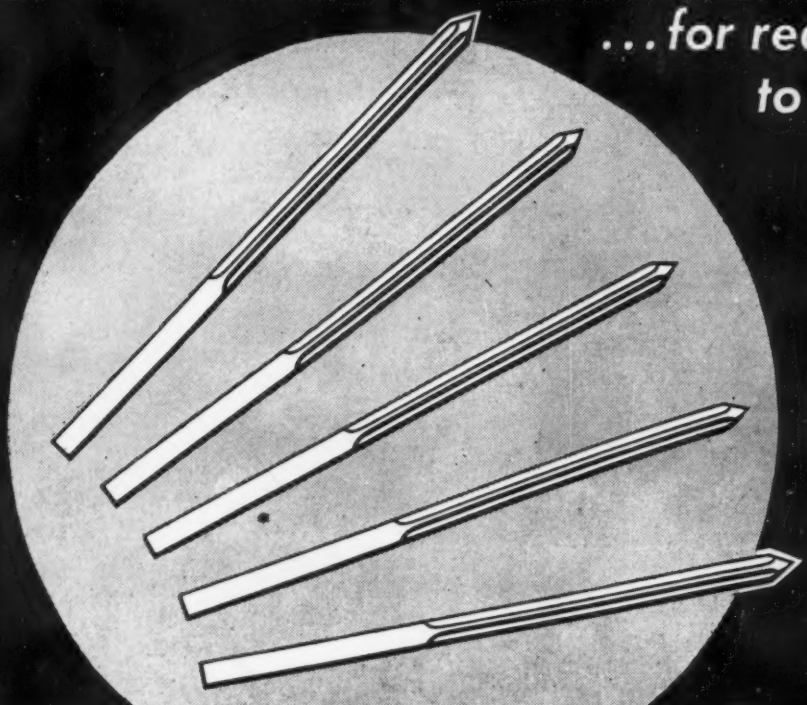
ARMY E NAVY

BAKEWELL MODELS
No. 0—0-80 to 10/24
No. 1—8/32 to 7/8
No. 1R—Radial
No. 2—3/8 to 2½
SEND FOR CATALOG

BAKEWELL
Manufacturing Co.
2009 SANTA FE AVE., 21 • LOS ANGELES, CALIF.

L & I SMALL HI-SPEED REAMERS with GROUND FLUTES

...for reaming small holes to greater accuracy and finer finish



L & I are specialists in the design and manufacture of small, high speed Reamers with Ground Flutes.

In the production of these tools careful attention is given to specified tolerances as well as the processes employed to assure keener cutting, a smoother surface finish, greater accuracy and longer life.

The stock used is centerless ground, high speed steel. Flutes are ground in after hardening, a feature which eliminates any possibility of distortion due to heat-treating. Keener, smoother surface finishing is assured by grinding cutter edge on both faces and lapping.

You can depend on L & I Reamers to give you the accuracy and finish you desire. Standard sizes from 1/16" to ¼" inclusive as well as special dimensions are available for prompt delivery.

Send for Descriptive Circular, giving specifications and prices.

LAVALLEE & IDE, INC., CHICOPEE, MASS.

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Main Office and Works, Stapleton, Staten Island, N. Y.

TAPPING CHUCKS

NEW YORK
170 Broadway

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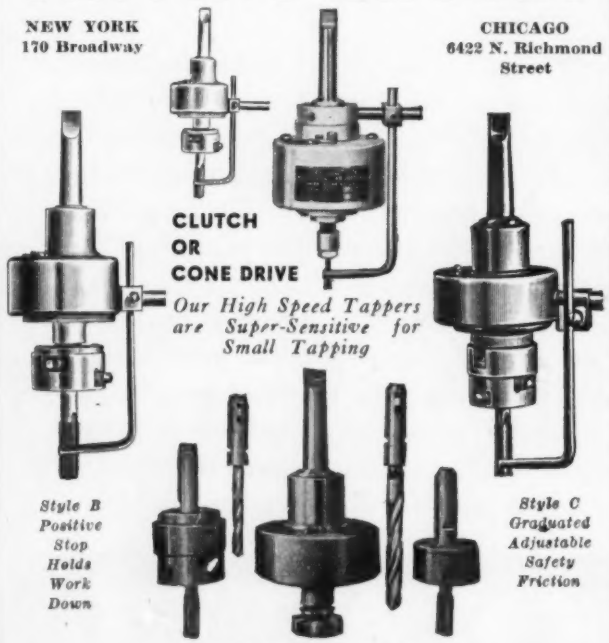
6422 N. Richmond Street



CLUTCH OR CONE DRIVE

Our High Speed Tappers are Super-Sensitive for Small Tapping

Style B Positive Stop Holds Work Down

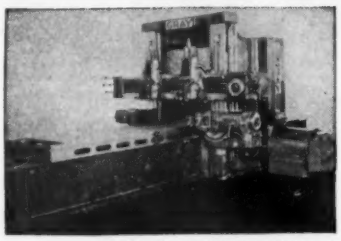
Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustments in each tap-holder. If required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

THE GRAY LINE



PLANERS

MILLING PLANERS

MILLING MACHINES
(Planer Type)

HORIZONTAL BORING MACHINES
(Floor Type)

Write for bulletins giving detailed specifications

The G. A. GRAY CO.
CINCINNATI, OHIO

HOLMAN

BETTER, FASTER HOLE FINISHING

HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
MANCHESTER, CONN.

LUCAS "PRECISION"

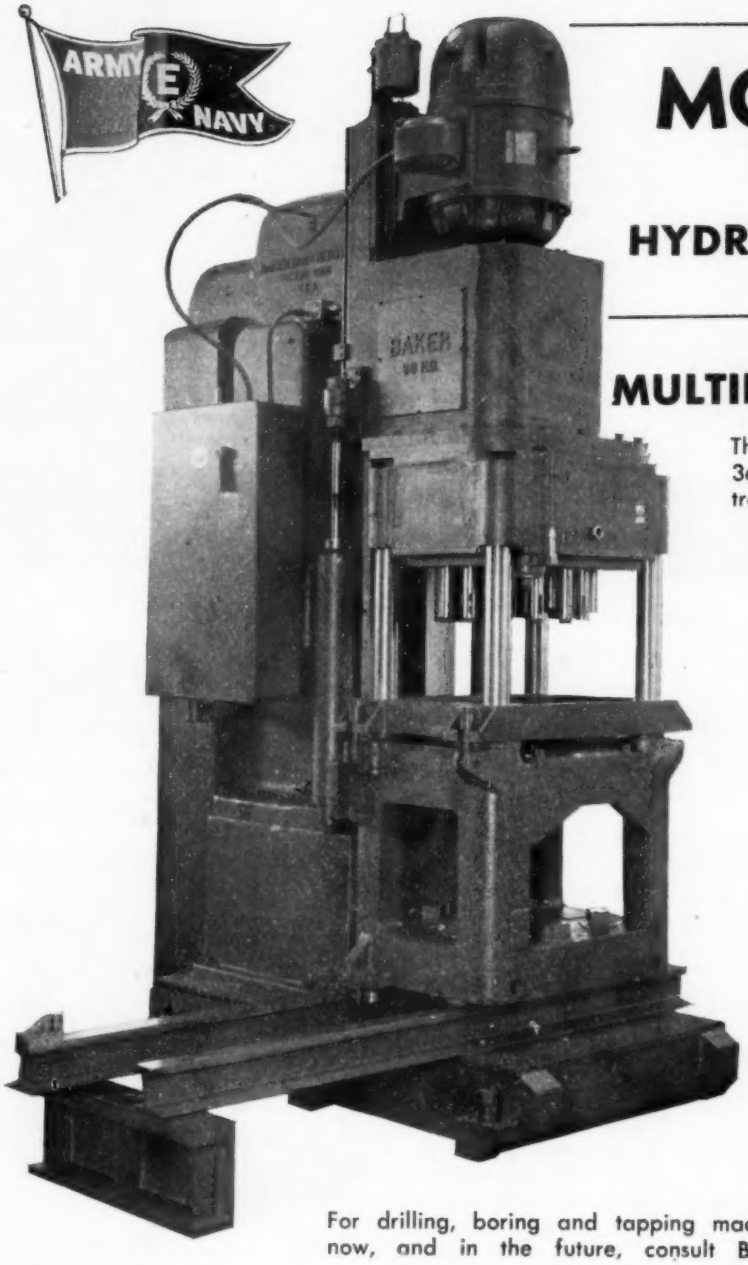
Horizontal Boring, Drilling and Milling Machine

THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF

CLEVELAND
OHIO, U. S. A.

BAKER



MODEL 36-HO

. . . A VERTICAL HYDRAULIC FEED MACHINE

for

MULTIPLE SPINDLE OPERATIONS

This special adaptation of BAKER's standard Model 36-HO, furnished for multiple drilling 29 holes in tank transmission cases, incorporates—

Special slide-over type fixture . . . designed by BAKER engineers.

Fixture to allow chucking large-size case casting, at left.

Multiple head with four large diameter pilot bars for accurate alignment and location of multiple head and fixture.

Extra-heavy duty multiple spindle head furnished with spindles mounted on ball bearings; all spindle ends furnished with vertical adjustment sleeves.

Head furnished with self-contained lubricant pump to insure lubrication to all gears and bearings.

Sight feed leveling gauge on front of multiple head.

Special fixture to permit multiple drilling of transmission case covers.

All of these features make for the highly productive, *continuous* service so necessary in today's war production. Of equal importance is the extreme flexibility of the BAKER 36-HO. Whether it is a special war job . . . or normal peace-time production . . . the BAKER 36-HO will handle either easily and successfully.

For drilling, boring and tapping machines designed to meet your special requirements now, and in the future, consult BAKER BROTHERS.

BAKER BROTHERS, INC. • Toledo, Ohio, U.S.A.

DRILLING • BORING • TAPPING

Our Motto Since 1867: "Machines Sturdy and Efficient, as Fine as Can Be Built..."

ARMY E NAVY

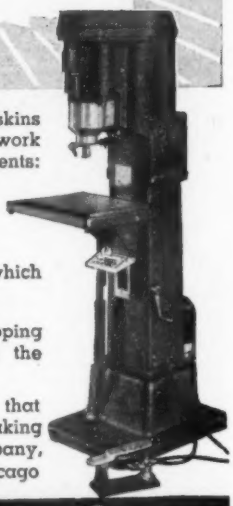
"E" TO UNIVERSAL FOR OUTSTANDING ACHIEVEMENT IN THE MANUFACTURE OF VITAL TOOLS . .

We are proud to announce that we have been awarded the coveted Army-Navy "E" in recognition of the quality and quantity of the Universal precision parts we have been producing for the war effort.

You can improve your jig operations with Universal Drill Bushings. They are straight and round and have superfinished bores for accuracy and long life. Write for complete catalog.

UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

AMERICA'S MOST ADVANCED TAPPING MACHINE



There's no tolerance problem on Haskins equipment. Absolute uniformity of work results from three Haskins developments:

Air Control which makes precision fit a constant factor, independent of operator efficiency.

Efficiently Engineered Fixtures which greatly simplify the handling of parts.

Piece-Part Control which makes tapping automatic except for placing parts in the fixture.

Send for TAPPING TIPS—new literature that gives many money-saving, money-making ideas. R. G. Haskins Company, 2761 W. Flournoy St., Chicago

HASKINS

HASKINS *Precision* TAPPING EQUIPMENT

The Original Manufacturers of Drill Chucks

The Almond Three-Jaw Drill Chucks were the first to be placed on the market. They were Pioneers in the field of Drill Chucks. For over seventy years Almond Chucks have formed a necessary part in the logical procedure of machine developments. Are made in types and sizes to fit all machine tools and portable drills.

Write for further information

Almond Drill Chuck

T. R. ALMOND MFG. CO.
ASHBURNHAM MASS. U.S.A.

SIGOURNEY M-100

EXTREMELY *Sensitive* TO MEET CLOSE PRECISION REQUIREMENTS

DRILLING MACHINE

The strength and rigidity of this newest model Sigourney drilling machine with its sealed ball bearings and hardened and ground spindles insure high speed operation with maintained accuracy.

For critical work on continuous schedules the M-100 may be operated at 4,000 to 10,000 R.P.M. . . . with full safety provided by complete enclosure of all moving parts except chuck and drill.

Multiple spindle machines, individually motor driven, are also available in 2, 3 and 4 spindle models. The use of rising blocks extends the range of work while the easy accessibility of driving belt and pulleys make speed changes a matter of seconds.

PROMPT SHIPMENTS TO QUALIFIED BUYERS

Send for detailed bulletin and prices. The Sigourney Tool Co., Hartford 6, Conn.

Sole Sales Agents

PRATT & WHITNEY

Division Niles-Bement-Pond Co. - - - West Hartford, Connecticut

a *Basic* design adaptable to *your* specific production needs and speeds

To key men concerned with small part production Bodine recommends serious consideration of this Basic design...a perfected coordination of vari-located spindles and an automatic horizontal indexing dial.

Investigation, thru our engineering department, will disclose practical adaptations of this principle — one or more of which may solve your toughest problems.

DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

Multiple spindles may be located at successive stations to operate vertically, horizontally or from inverted positions, on work held in clamps on the automatic indexing dial.

For highspeed repetitive production, especially where several operations are required on each part, drilling, milling and tapping may be performed simultaneously, during one cycle of the dial. Moreover, screw inserting can be added if necessary.

There are six standard Bodine machines, each of which is adaptable for a wide variety of set-ups. They carry from 6 to 8 spindles, drill holes up to ½" dia. with vertical stroke to 3½" depth.

Operators may be quickly trained as both set-up and feeding are simplified. In most cases the parts are hand fed and automatically ejected. Electrical interlocks protect tools, machine and operator.

Study the operations shown at right... they are typical of the many possibilities of these highly diversified machines.

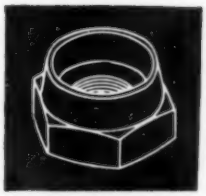
Production recommendations will be made from your sample parts or blue-prints. Send for Bulletin for detailed information.

TYPICAL OPERATIONS FOR #40 - 10

Tooled for processing contact blades for attachment plug caps. Operations: Tapping 6-32 hole, inserting binding screw (automatically hopper fed to screw driving spindle), spinning (or staking) screw on end, backing up screw, inspect and eject. Hi-production, accurate finish.

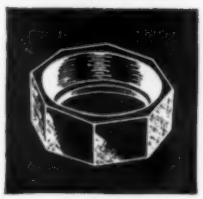
TYPICAL OPERATIONS FOR #42 - 30

This special (Bodine patented) set-up is for rapid production of accurately located holes in a delicate ordnance component. Operations: seven holes drilled (sizes .5mm to 2.8mm dia.) with tolerance for center distance .0004". By changing dials and relocating spindles many different set-ups can be made on a single machine.



TYPICAL OPERATIONS FOR #48 - 20

Here is a dial and tooling arrangement for producing a special type nut. Blanks are hand loaded to dial. First spindle drills for equivalent of a counterbore diameter. Second spindle drills the tap hole thru the blank, and next spindle taps the hole to class 3 fit, square with face of blank. Two completed nuts to each stroke of machine. Speed depends upon size of nut and material.



TYPICAL OPERATIONS FOR #48 - 30

To drill and thread this ¾" malleable iron pipe union nut, heavy duty drilling and threading spindles (2 of each) are provided. The collapsible taps produce the thread in minimum time. Operations: Ream 2 diameters and seat, tap 1 ⅞" — 12 T.P.I. Even semi-skilled operators obtain maximum production.

THE
Bodine
CORPORATION
BRIDGEPORT CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

GREENFIELD
NO. 4 TOOL AND CUTTER GRINDER
Ideal for Tool Room or Shop

This machine is furnished either as a Plain Cutter or Reamer Grinder or as a Universal Machine (4U) with attachments for extending its utility.

Modern, sturdy construction is used throughout. Standard is integral with base and extra broad knee is splined to standard. Sleeve of elevating hand wheel is graduated to thousandths of an inch. Head swivels 90° each side of center and is also graduated. Wheel head and spindle are designed for heavy work. Table rests full length on longitudinal slide and is provided with screw adjustment for aligning centers for straight or taper grinding.

Attachments (for Universal Machine) are available for Cylindrical and Internal grinding.

Write for full information

CONDENSED SPECIFICATIONS

Swing over Table 8½" — Longitudinal Table Travel 16" — Table Surface — 5½" x 28" — Cross Feed — 6" — Vertical Feed — 7" — Will grind cutters on holder — 10" dia. — Capacity Chuck 4" — Will grind cutters on centers — 8½".

PRODUCTION MACHINE CO.
Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.
GREENFIELD, MASS., U. S. A.

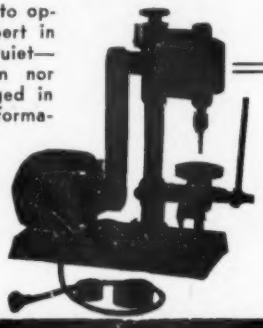
For Sensitive Tapping of Precision Work

HAMILTON-MUEHLMATT
SENSITIVE TAPPING MACHINE

● Here's a high speed, sturdy little tapping machine which is especially adapted to precision tapping of light work. It is now being used very successfully for tapping parts for instruments, cameras, watches, clocks and business machines.

It has gained wide acceptance due to the high quality of work produced because of its particularly smooth operation without breakage of even the finest taps.

Mechanically simple and easy to operate, a man can become expert in an hour or so of operation. Quiet—no noisy reversing mechanism nor slinging of oil. Can be plugged in any light socket. For full information write for bulletin.



PERTINENT DATA

Capacity—From smallest and finest tap to 10-32 inclusive
Power—¼ H.P. 1750 R.P.M. Motor either CI-AC or compound DC
Tapping speeds approx 1200 to 2600 R.P.M.
Size of machine—16 in. x 7 in. x 22 in. high
Weight—Approx. 60 pounds

The Hamilton Tool Co.
830 NINTH ST HAMILTON, OHIO

NATIONAL KEYSEATING MILLER

. . . the tool that converts drilling machines into key-seaters and saves time and money

● With this modern tool you can handle keyseating jobs not suitable for keyseating machines on any of your drill presses or radials. Keyseats with parallel sides, accurate in depth and in perfect alignment with bore axis are assured.

The National Keyseating Miller mills, keyseats in one cut. It can be used on taper holes, offset holes, blind holes and for taper keys. Work clamping is unnecessary. We also manufacture oil-grooving millers.

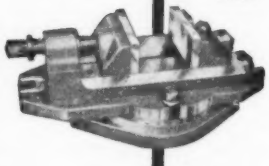
Made in twenty-six different diameters from ½" to 3½". Several widths of cutters can be used in each size.

WRITE TODAY FOR OUR NEW CATALOG NO. 15

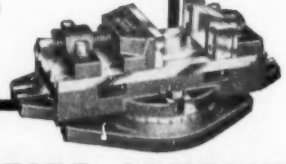
NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

Producto MODERN MACHINE Vises

6" Heavy Duty General Purpose Vise



4½" Swivel Vise for tool rooms and machine shops



6" Heavy Duty Swivel Vise

● There are no Vises that compare with PRODUCTO Vises.

These superior and modern Vises are so much better than the conventional design.

Bodies fitted with hardened and ground wearing plates — extra large opening between jaws — large screw and nut for movable jaw — make these 4½" and 6" Vises practically indestructible and useful for very long wear.

We also make Cam Lock Vises in 4" 5" and 7" sizes for production milling and drilling operations. Best vise for this purpose.

Don't bother with old tools — use Modern Machine Vises.

Ask for 8-page circular—

Also manufacturers of Producto Die Sets and Die Makers' Accessories.

The
PRODUCTO MACHINE COMPANY
940 HOUSATONIC AVE. BRIDGEPORT, CONN.
3017 MEDBURY, DETROIT, MICH.

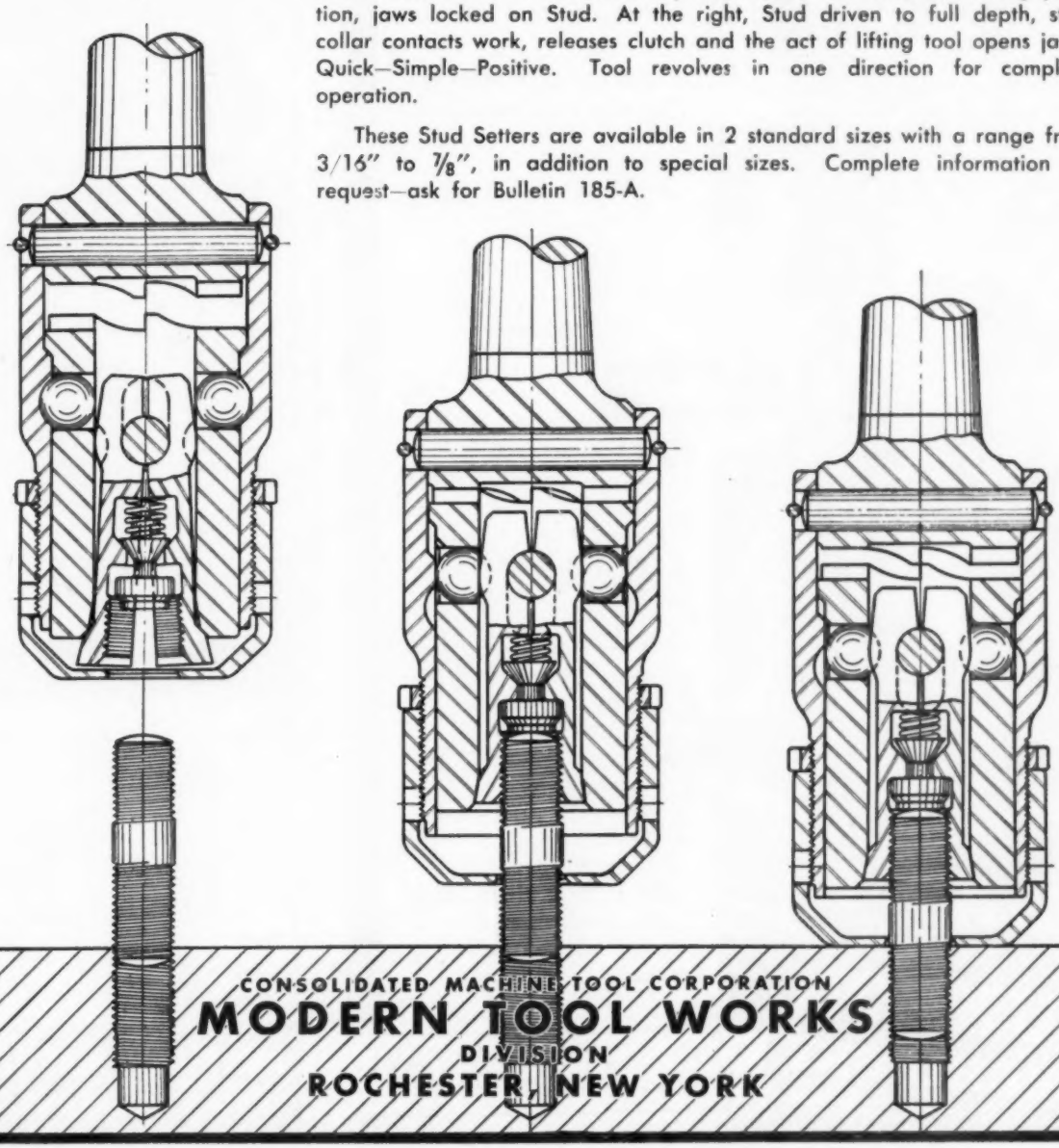
SPEED-UP YOUR STUD SETTING WITH

MODERN SELF-OPENING STUD SETTERS

HERE'S HOW IT WORKS!

The 3 steps in setting studs with a Modern Self-Opening Stud Setter are shown below. At the left, Jaws open to take stud. Middle, Driving position, jaws locked on Stud. At the right, Stud driven to full depth, stop collar contacts work, releases clutch and the act of lifting tool opens jaws. Quick—Simple—Positive. Tool revolves in one direction for complete operation.

These Stud Setters are available in 2 standard sizes with a range from 3/16" to 7/8", in addition to special sizes. Complete information on request—ask for Bulletin 185-A.



CONSOLIDATED MACHINE TOOL CORPORATION

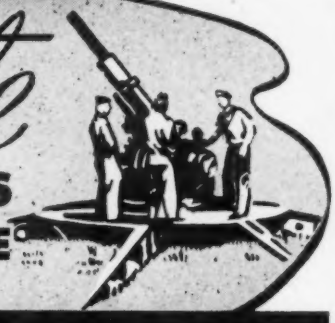
MODERN TOOL WORKS

DIVISION

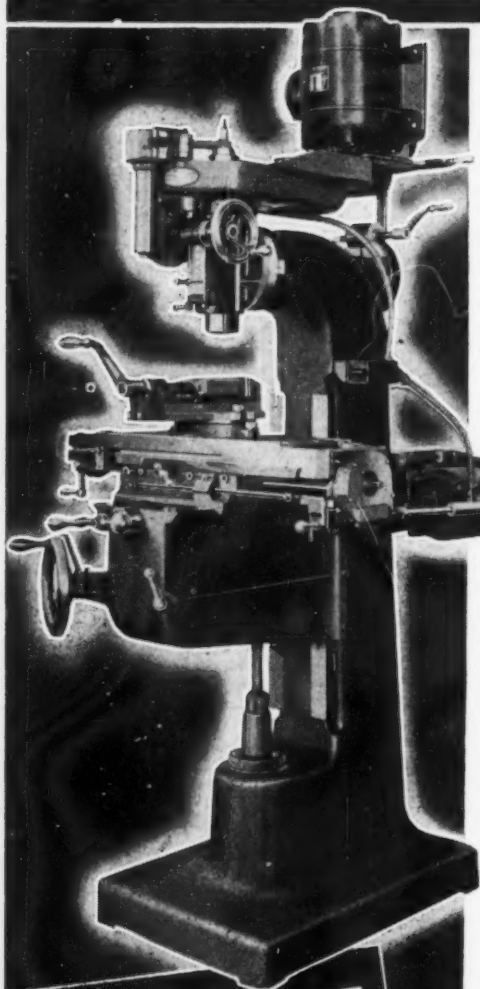
ROCHESTER, NEW YORK

Accurate

AS THE GUNS THEY HELP PRODUCE



INDEX MILLS



Manufactured by Index Machine and Tool Co., Jackson, Michigan

CHECK THESE FEATURES!

★ Precision Ball Bearing Spindle that will require no attention for two years.

★ Swivel Head which can be set 90° right or left.

★ Super construction sensitive enough to do work with end mills 1/8" diameter yet rugged enough to use 3/4" end mills taking full cuts 24 hours a day.

★ Verniers for locating, and power feed to spindle for boring.

★ A versatile machine that can be used in the tool room or on the production line.

Send inquiries for immediate quotation and quick delivery to Factory Sales and Distributing Agents.

BLANK and BUXTON MACHINERY

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JACKSON, MICHIGAN

KNOW YOUR MATERIALS AND HOW TO WORK THEM

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• Here, in compact, easy-to-use form, are digests of authoritative Metal-Working practice followed in war-busy plants. Each reprint appeared originally as one of the well-known *American Machinist* "blue sections." Each details characteristics of a particular material or group of materials . . . tells what they are and how to work them. Production executives find these compilations useful in employee training.

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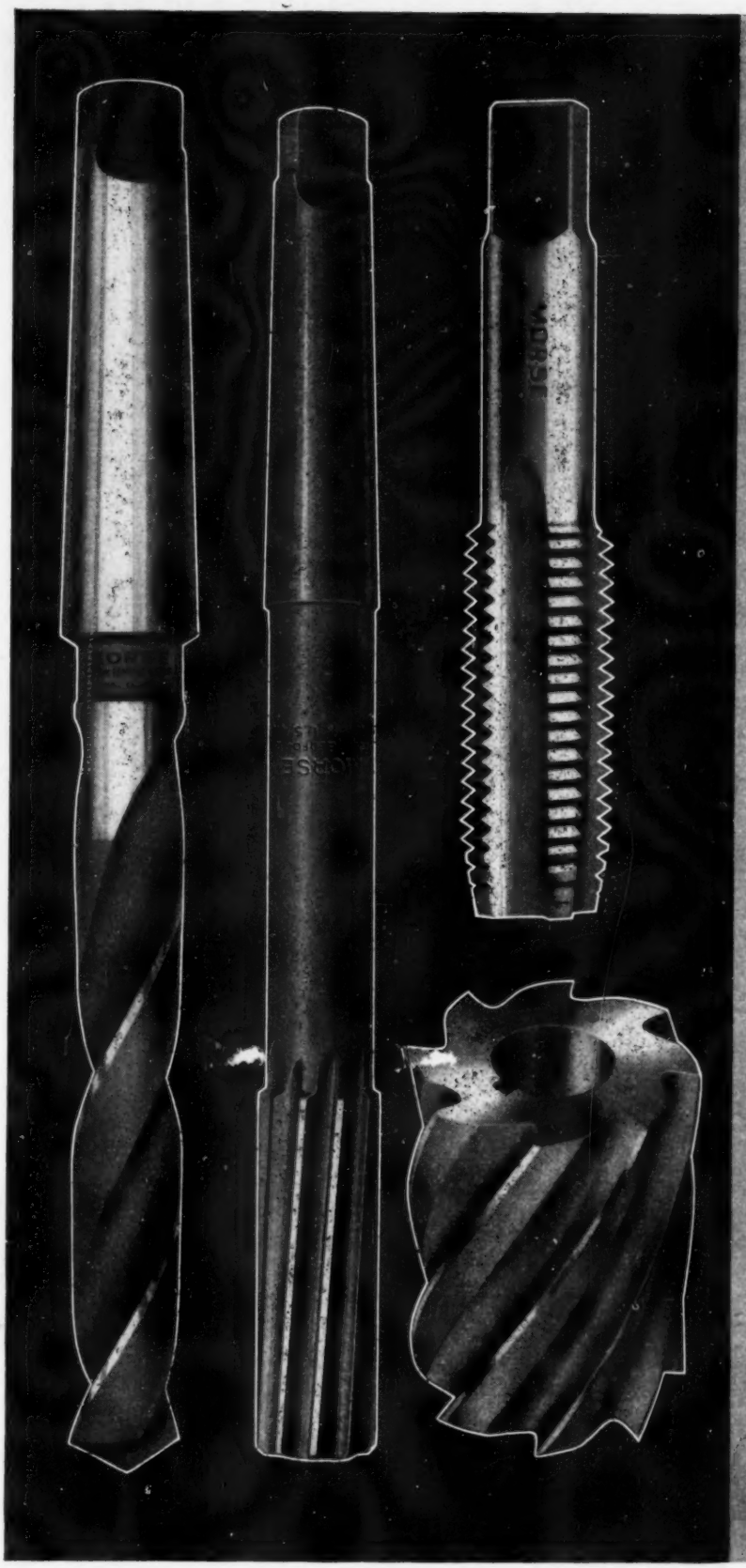


RAISE YOUR SIGHTS!

The output of your machines is determined by the quality of the cutting tools you use.

MORSE THERE IS A DIFFERENCE **TWIST DRILL AND MACHINE COMPANY**
NEW BEDFORD, MASS., U. S. A.

NEW YORK STORE: 130 LAFAYETTE ST. - - - - CHICAGO STORE: 570 WEST RANDOLPH ST.

CLEVELAND *Open Side* PLANERS

▶ The modern design — the rigidity — the stamina of the Cleveland Open Side Planer is proving a real asset in hundreds of plants now turning out vital war material for our wide flung battle fronts.

Today Cleveland Planers are meeting the exacting precision demands of a nation at war. Tomorrow the same rigidity and accuracy will be available in Cleveland Planers to meet production requirements in which low costs will become more and more essential to sales in a competitive market.

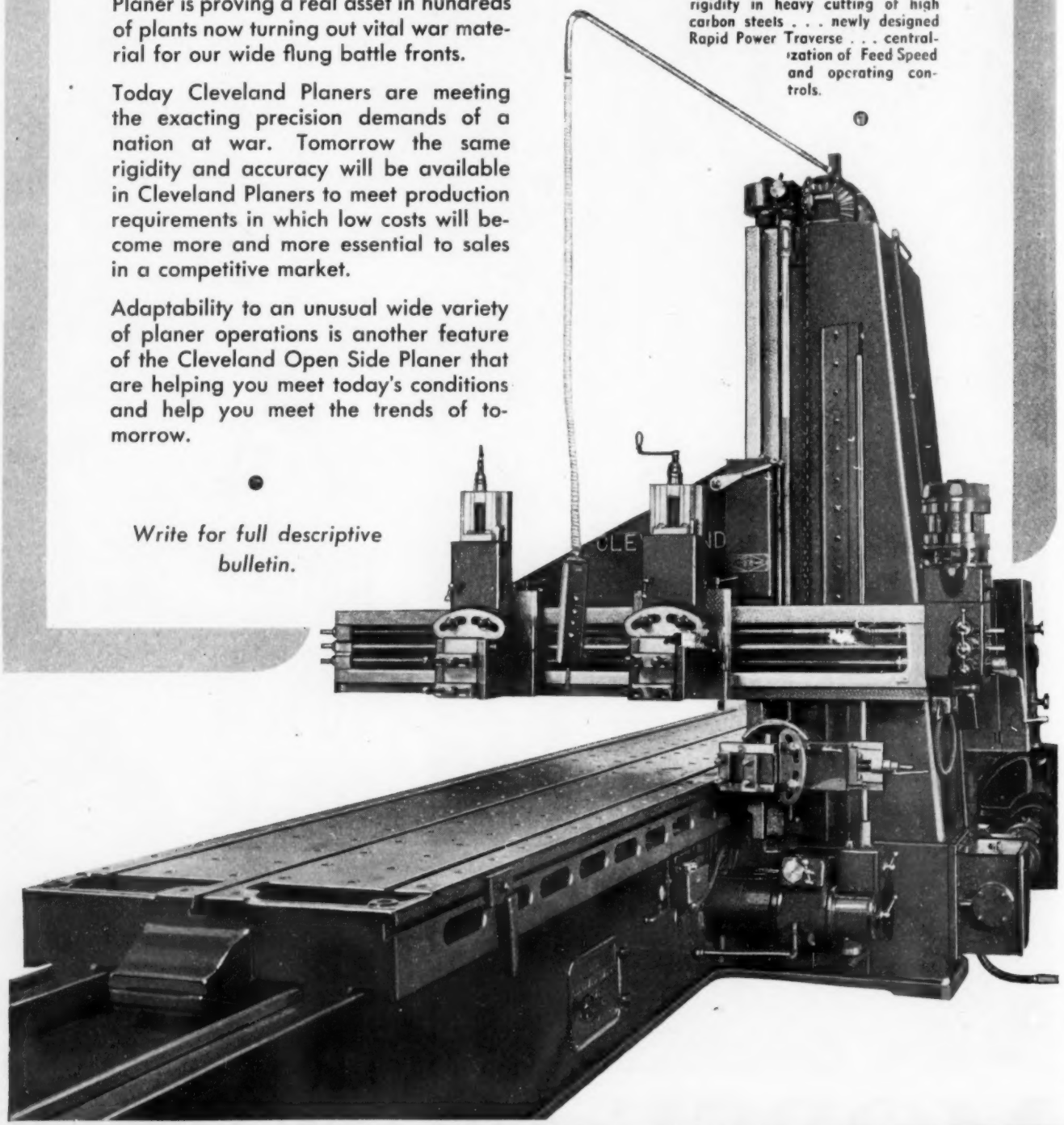
Adaptability to an unusual wide variety of planer operations is another feature of the Cleveland Open Side Planer that are helping you meet today's conditions and help you meet the trends of tomorrow.

●

Write for full descriptive bulletin.

NEW SERIES FEATURES:

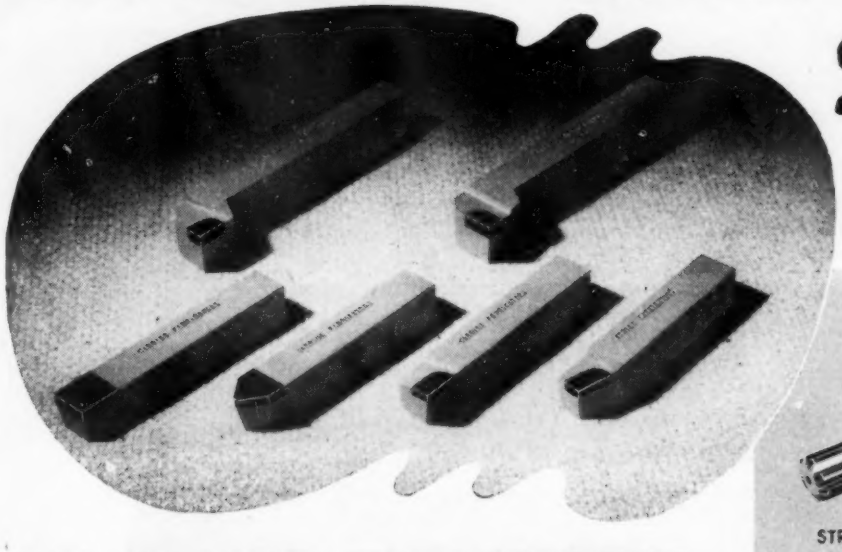
Improved head design for greater rigidity in heavy cutting of high carbon steels . . . newly designed Rapid Power Traverse . . . centralization of Feed Speed and operating controls.



THE CLEVELAND PLANER

3148-3156 SUPERIOR AVE., CLEVELAND, OHIO

These ARE THE CEMENTED-CARBIDE TIPPED TOOLS SUPPLIED AS *Standard* BY CARBIDE FABRICATORS



48 HOUR DELIVERY

ON TURNING TOOLS SHOWN ABOVE

The wear resistance of cemented-carbides is available to you in many different types of standard tools manufactured by Carbide Fabricators.

The standard turning tools shown above—ground ready for use and which also meet many requirements for boring and facing jobs—are produced in large volume to be carried in stock. Simplified pricing of these tools makes possible one low unit price regardless of the number of tools which are ordered.

Reamers, end mills and core drills are all produced to a high degree of accuracy. Machine reamers, shell reamers, end mills and shell core drills are held to size within a total tolerance of .0005". When specified, closer tolerances can be supplied at a slight additional charge.

Complete information on any of these tools will be supplied immediately upon request.

We are authorized suppliers of Carboloy, Vascoloy-Ramet and Firthide cemented-carbides.

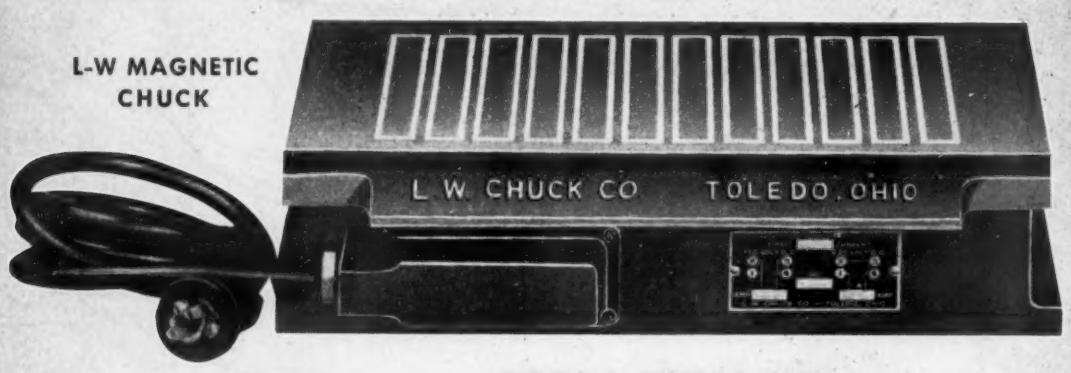
CF Carbide Fabricators ROYAL OAK MICHIGAN

DIVISION OF MORSE TOOL COMPANY • DETROIT

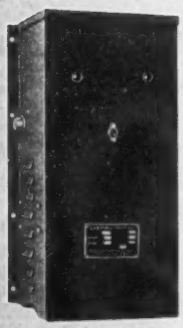
MAGNETIC CHUCKS

. . . guaranteed maximum magnetic holding power, constructed for long life, water-proof for wet or dry grinding. These features plus scientific design and highest grade materials are your assurance that L-W Magnetic Chucks will properly fill all requirements . . . meet any demands. L-W Magnetic Chucks are built in four sizes, supplied with connections to operate on either 110 or 220 volt D. C.

L-W MAGNETIC CHUCK



L-W



RECTIFIER, converts A. C. into D. C., for use on magnetic chucks. A. C. input 110 volts. D. C. output 110 volts, 8 amps. Suitable for use with our 5¾ x 13 and 6½ x 18 magnetic chucks . . . Price **$25.00.** Larger capacity rectifiers available.

MAGNETIC CHUCKS

Working Surface 10¾" wide, 37" long	$202.05
Working Surface 8" wide, 24" long . .	109.30
Working Surface 6½" wide, 18" long .	63.15
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DEMAGNETIZERS

Model B-2 working surface 7¾" x 12½" x 6¾" . .	$63.20
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DEMAGNETIZING SWITCHES

Field Discharge Type $16.25
L-W Demagnetizing Switch 8.90

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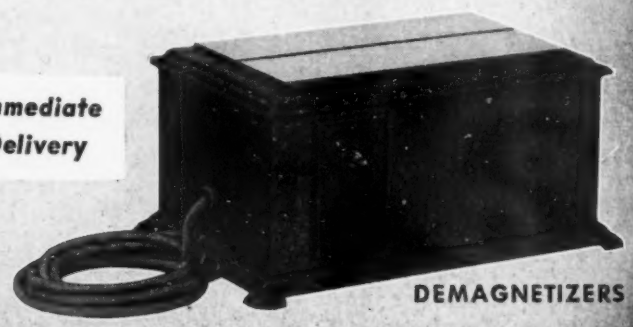

DEMAGNETIZERS

A new catalogue is available . . . send for your free copy today!

L-W CHUCK COMPANY

1-7 N. ST. CLAIR ST.
TOLEDO, OHIO

Also manufacturers of LATHE CHUCKS • DIVIDING HEADS • MILLING MACHINE VISES • POWER HACK SAWS

NO TIME FOR "Coasting"...

SPEED PRODUCTION

WITH KENT-OWENS MACHINES!

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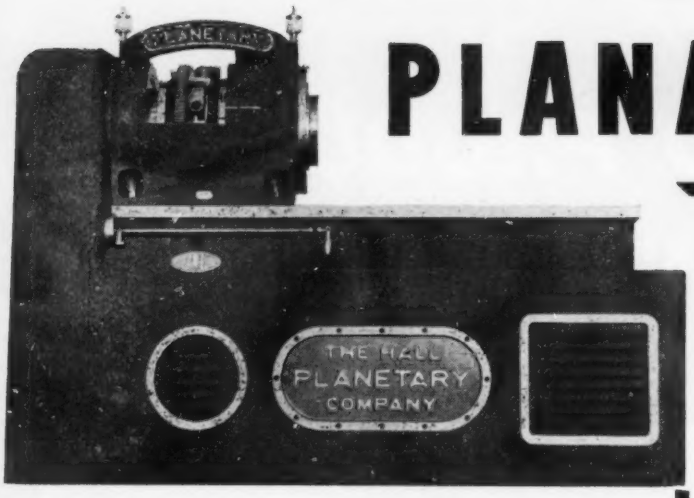
★ In this war, it's an "uphill pull" for industry *all the way* until Victory. Even though we're starting to beat the Axis now... there's still a long way to go... and no time for "coasting"!

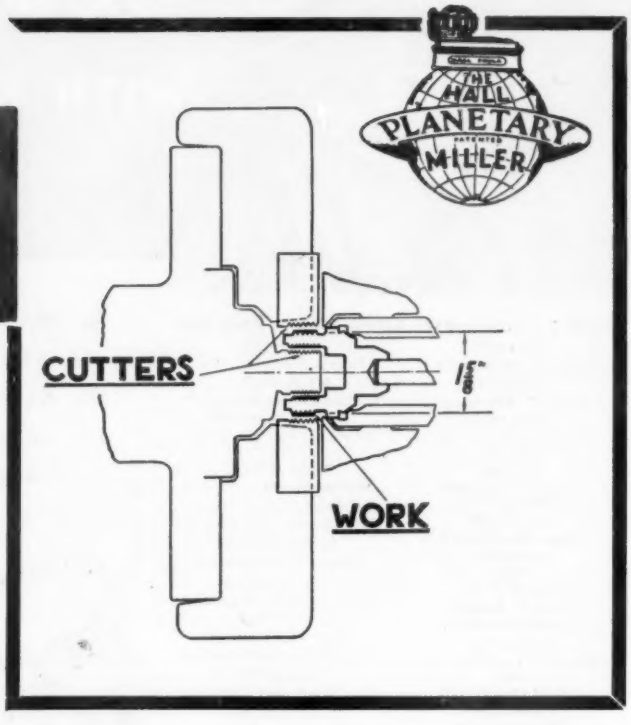
For greater *speed and accuracy* in production... get milling jobs done *right* with Kent-Owens Machines! They're rugged... simple... efficient... designed with practical features that green hands quickly learn to master. Send for latest bulletins. Kent-Owens Machine Co., Toledo, Ohio.

No. 2-20 Milling Machine—
Table, 42" by 12". Table travel, 20"

Call on KENT-OWENS *for Milling Machines*

PLANAMILLING





THREADS MILLED SIMULTANEOUSLY IN 45 SEC.

On the piece shown (a shell part), both threads are milled simultaneously in 45 seconds. Both of these threads are of different pitches and can be either right or left hand.

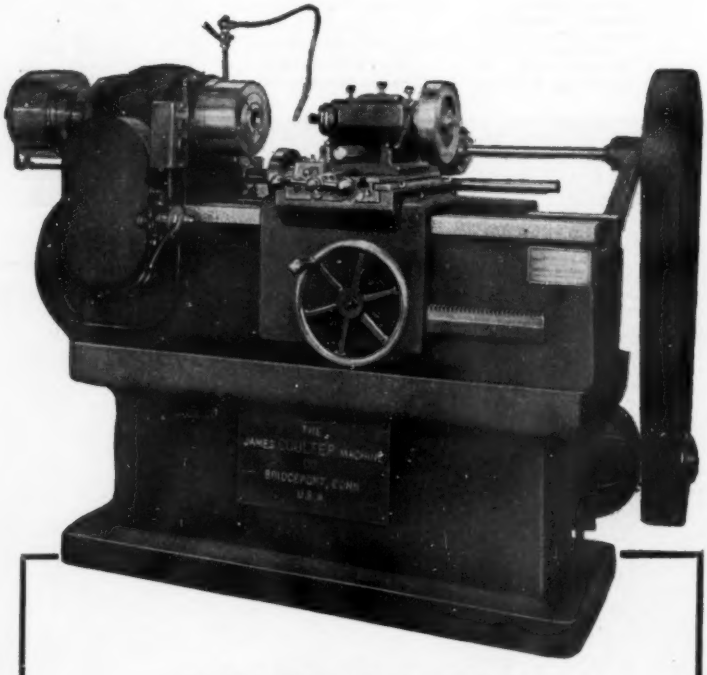
Simultaneous milling of both threads assures concentricity of both threads with each other and with the locating surfaces.

This normally difficult operation is easily handled on the PLANETARY.

Our engineers will gladly offer suggestions for speeding up your production

The
HALL PLANETARY COMPANY
Fox St. & Abbotsford Ave.
Philadelphia, Pa.

Keep Ahead of DEFENSE DEMANDS *on the PRODUCTION of* EXTERNAL and INTERNAL THREADS



The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

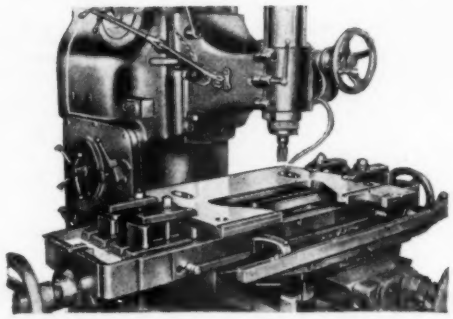
Maximum external thread, 7"; minimum hole depends on smallest hob practical.

Send for Descriptive Bulletin giving full information.

The James COULTER Machine Co.
BRIDGEPORT • CONNECTICUT • U.S.A.

KNIGHT
VERSATILE · ACCURATE · RIGID · MILLERS

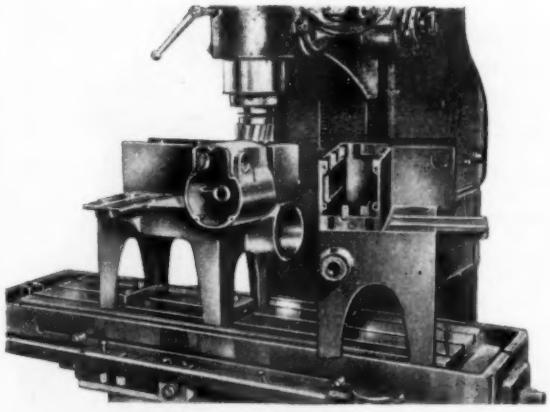
GREATER Speed ON WIDE RANGE OF WORK



WIDE RANGE EXAMPLE

LIGHTMILLING: Many operations were performed on the large one-inch steel plate at one setting, including profiling, milling, boring, slotting, and keyway cutting. KNIGHT MILLER'S wide range of spindle speeds, solid table unit, and ease of handling provide efficient production and accurate results on all of these operations.

- *Short time required to make set-ups, particularly the difficult ones.*
- *Elimination of additional set-ups or their simplification.*
- *Quick and accurate location of holes and surfaces —especially when dial indicators are used.*
- *Quick change of vertical settings by moving the spindle instead of the work.*
- *Fast method of changing cutting tools.*
- *Reduction of time waste in set-up work through swiveling table.*



GREATER SPEED EXAMPLE

Four hundred pieces of five-inch channel nineteen inches long as shown in the illustration, were faced off on their full width and length with a six-inch face mill, removing from .015" to .030" in five and one half minutes from floor to floor. For greater rigidity and smoother finish the cutter is mounted directly on nose of spindle.

YOU CAN CHANGE QUICKLY FROM ONE JOB TO ANOTHER WITH A KNIGHT-MILLER

• Let us tell you more about this feature and the many other KNIGHT MILLER advantages — all so important in today's victory production.

While perfectly capable of doing a wide range of ordinary plain milling and boring, the KNIGHT MILLER is able to quickly and accurately machine difficult and unusual parts without special equipment.

The ease and convenience of getting adjustments on the KNIGHT MILLER saves work and time for the operator. All vertical adjustments are simply obtained by moving the counter balanced spindle and spindle head rather than a heavy table unit.

Catalog describes each KNIGHT MILLER ability and gives performance examples — send for it.

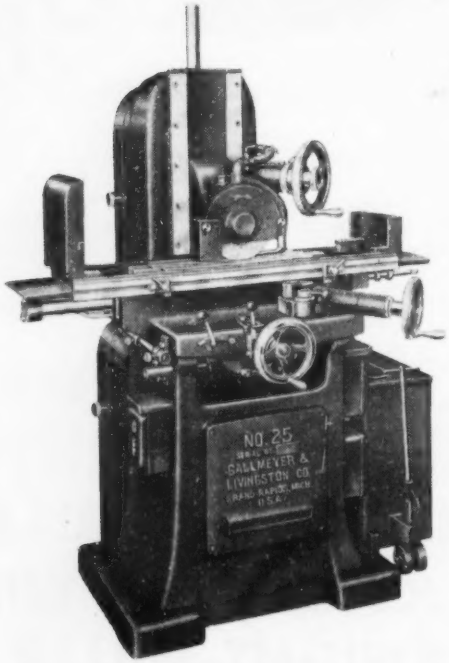
W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

TOOL ROOM ACCURACY COMBINED WITH PRODUCTION SPEED...

GRAND RAPIDS

HYDRAULIC FEED

SURFACE GRINDER No. 25



★ Built around a heavy, rugged, one-piece column and base casting to assure permanence of alignment between vertical headways and cross-travel ways.

These machines are equipped with potential vertical movement of wheel head mounted in a location convenient to the operator and providing for a circular Vernier reading from a small flat graduated dial in the center of the hand wheel. The large outer hand wheel provides for rapid raising and lowering of the wheel head while the smaller inner wheel provides for the final setting.

SPECIFICATIONS

Maximum longitudinal table speed	80 ft. per minute
Automatic table travel, longitudinal	20"
Automatic table travel, transverse	6½"
Working surface of table	6" x 18"
Standard spindle speeds	2900 and 3400 R.P.M.
Floor space	70" wide x 61½" deep

GALLMEYER & LIVINGSTON CO.
330 STRAIGHT AVE., S.W.
GRAND RAPIDS 4, MICH.

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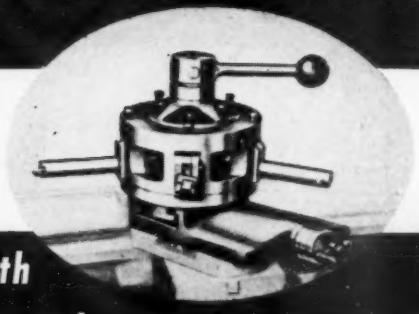
10 INDEXED TOOL POSITIONS AVAILABLE WITHOUT CHANGING WORK SET-UP



with Improved 5-Station Turret Heads

Any engine lathe can be quickly and easily converted into a fast, efficient highly productive turret lathe by the simple addition of one of these heads which are furnished complete ready for assembly with five oscillating tool blocks.

By turning handle ⅛th revolution and lifting it 45° the turret head is released for turning in either direction to any one of ten positions allowed by the indexing. Tool bits may be rotated as well as tilted in any position to permit more exact settings and assure maximum cutting efficiency. Ability to use ordinary tool bits without special adapters means a saving in tool bits, more rigid operation and ability to make heavier cuts. The use of boring bars is also possible in this head.

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AUTOMATIC MACHINE & TOOL CO.
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Both Arch and Overhang types in sizes up to 6" plunger diameter are available.

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Lovejoy Milling Cutters are the choice of precision machine tool builders. This is logical, because no machine tool is more accurate than the sum of its parts. The illustrations show Kempsmith Maximillers, with Lovejoy Type "A" Cutters, milling parts for other Maximillers. These machines and cutters are producing parts at high production, to close tolerances, and with fine finish—just what *you* require, regardless of the parts or products being made.

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PHOTOS COURTESY THE KEMPSMITH MACHINE CO.

Milling the front face of the milling machine knee with a Lovejoy Type "A" Milling cutter.

Complete details on the Lovejoy line of modern milling cutters will be found in Catalog No. 26. Write for your copy today.

LOVEJOY TOOL COMPANY, Inc.
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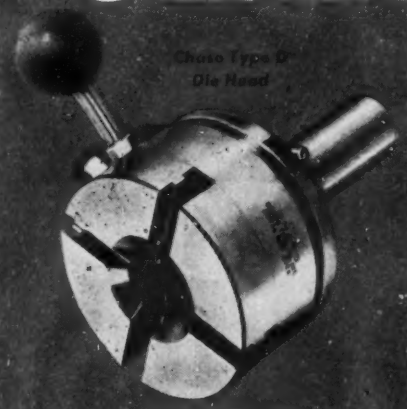

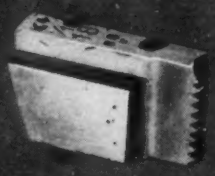

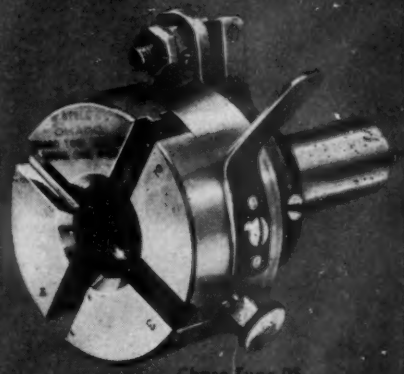

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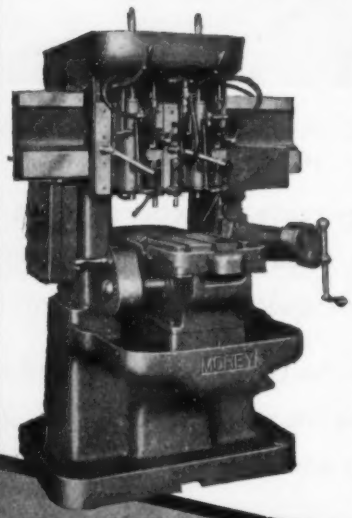

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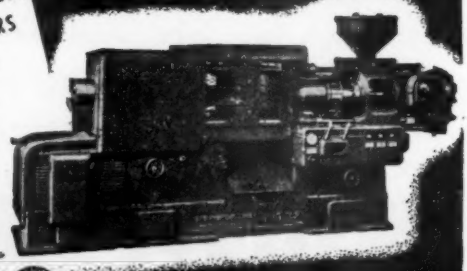

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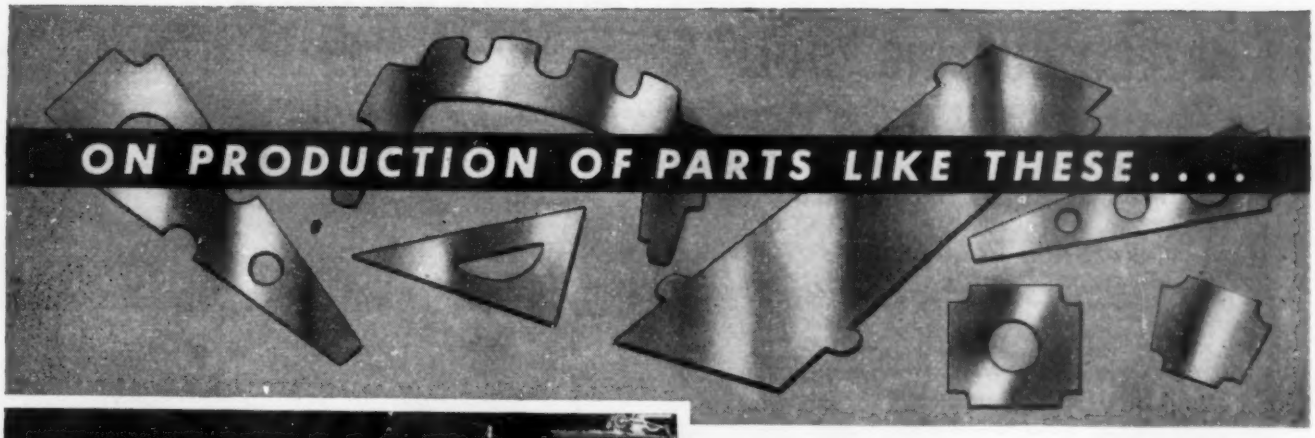

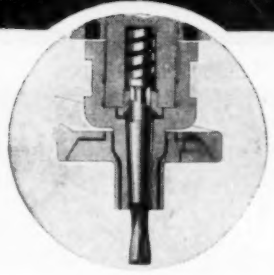

THIS TRIO SAVES TIME—LABOR—MATERIAL

High speed production routing of irregularly-shaped non-ferrous parts is possible with the three Onsrud products described here.

The Onsrud Radial Arm Router has a spindle speed of 15,000 RPM for smoother, faster routing of both inside and outside cuts. Completed work has clean, finish-smooth edges.

Onsrud machines and tools pioneered high speed, fast feed working of non-ferrous material. It will probably pay you to get the help of Onsrud engineers in solving your problems. Write today for "Tricks and Tips on Radial Arm Drilling and Routing" and for further information on Onsrud methods and how they may be applied to your operations.

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This new Onsrud chuck design eliminates long over-hang and increases chucking grip. Close chucking gives the bit increased rigidity, eliminating all "whip" and reducing bit-breaking vibration.

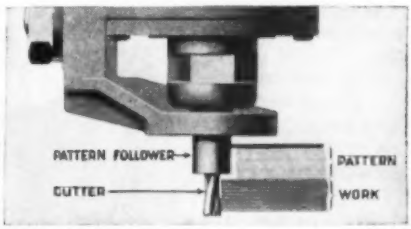
Because the Inverted Taper Shank Bit used is always perfectly centered and correctly chucked, life of bits and spindle bearings is increased. The over-all result is faster, smoother cutting, easier feeding of bit, and less operator effort to do the work.

Onsrud Spiral Bit Grinder

With the GF-41 Spiral Bit Grinder, spiral router bits with straight or taper shanks are sharpened speedily and with factory-like accuracy and precision in your own shop.

In operation, bit is held in chuck and moved to and from the grinding wheel by a hand lever. Cam provides proper bit lead. Entire motor assembly swivels for correct adjustment to any grinding angle.

Full details on this high-speed, air-powered unit sent on request.



Here's how the Onsrud Radial Arm Router cuts parts from stacked, flat or corrugated sheets. A pattern is fixed to the sheets and the pattern follower travels along the pattern's side. Both inside and outside cuts are made accurately and speedily.

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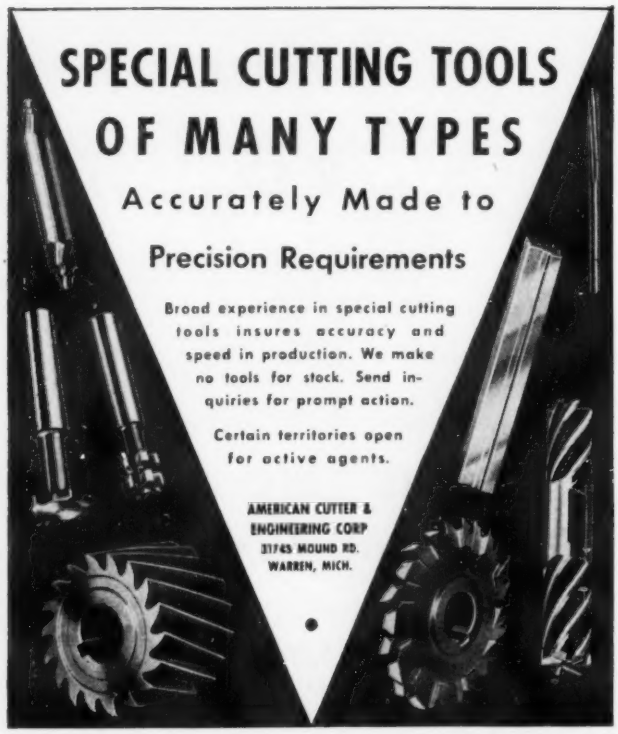

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Speed and Precision

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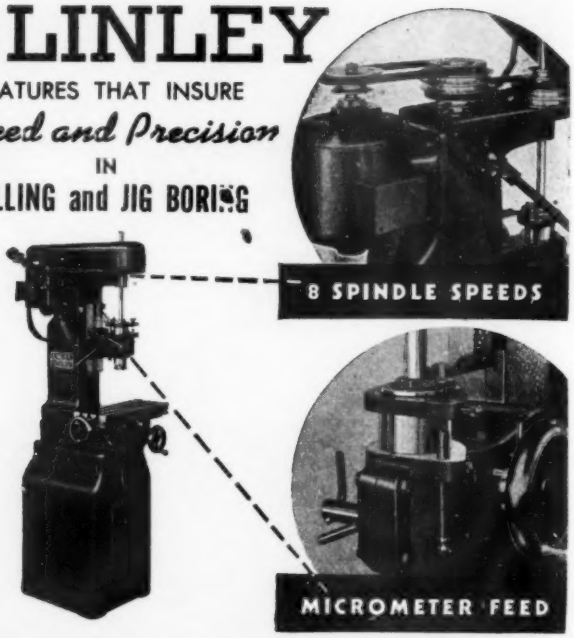
MILLING and JIG BORING



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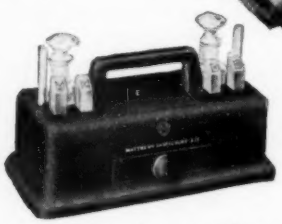

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9. Interchangeable Manufacture and Inspection
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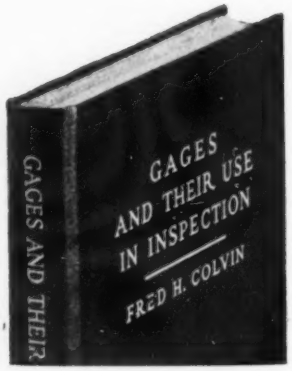

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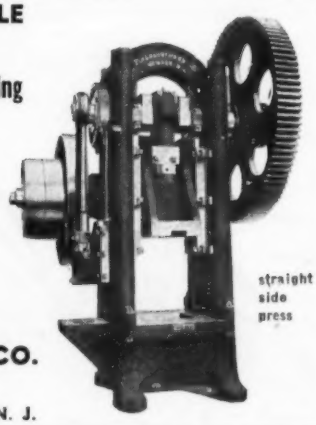

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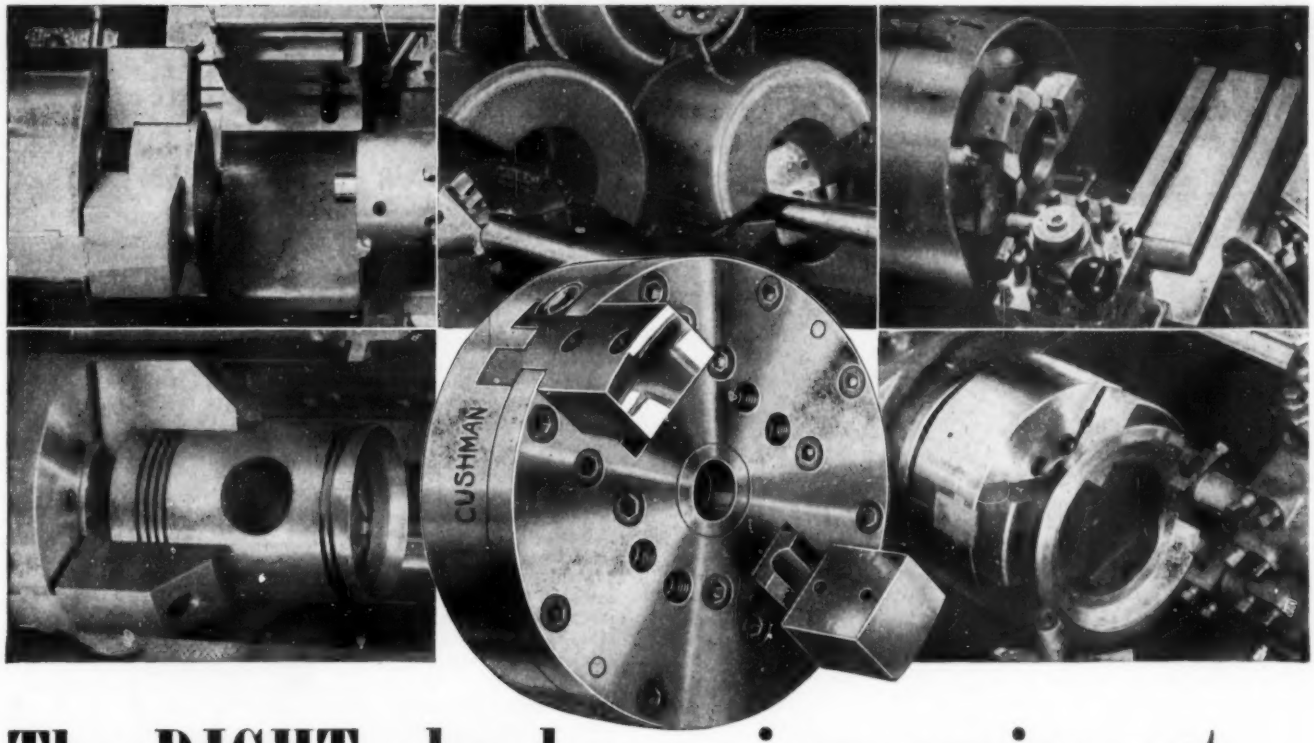

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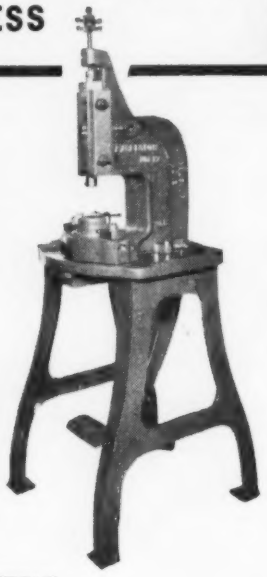

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Capacity—½" through 1/16" soft steel

Immediate deliveries available. 12 different sizes available.

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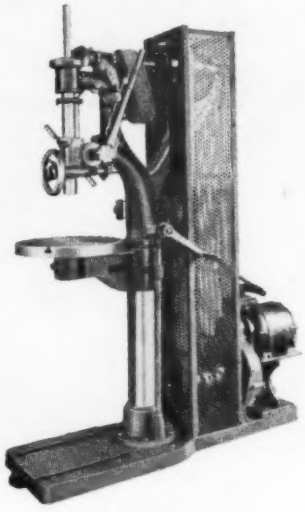

SPECIFICATIONS

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Diameter of Table—18"
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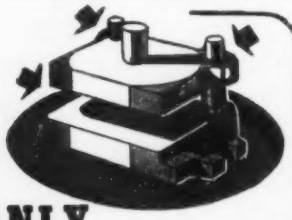

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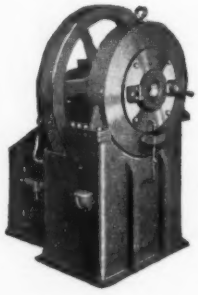

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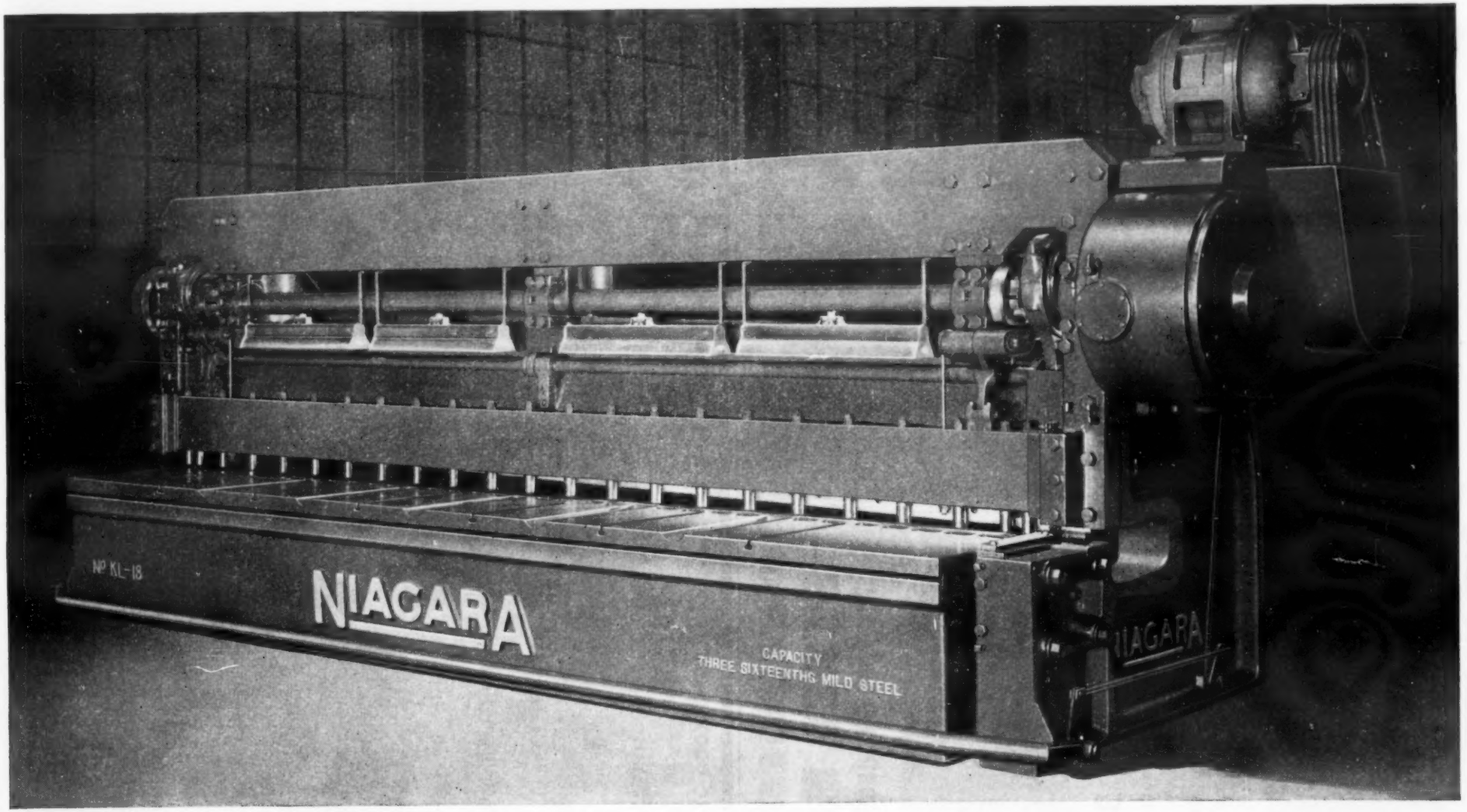

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- Water pot
- Adjustable, shatterproof, clear glass eyeshields.

All QUEEN CITY Grinders are supplied fully equipped — ready for immediate use. Built in a complete range of types and sizes, QUEEN CITY Grinders are available in bench, pedestal, and heavy duty box type bases . . . units from 1 H.P. to 10 H.P. Initial cost is well under that of comparative units.

QUEEN CITY MACHINE TOOL CO., 218 East Second St., Cincinnati, Ohio

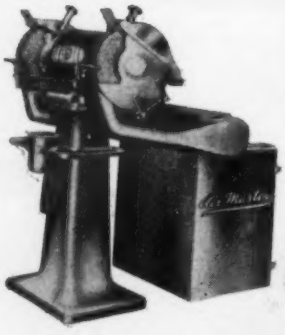
---

For Want of a Nail . . .

It's true that sharp tools cut production costs. But efficiency slumps when the same tools that put sharp edges on cutting tools spew out abrasive grit and dust to attack close-fitting parts of costly machinery.

For want of a nail, a shoe was lost. For want of a way to halt the attacks of grit and dust on machinery—and on workers' lungs, too—vital production can suffer.

The Cincinnati Air Master—easily cleaned, easily installed and built in three sizes to fit all grinders and buffers—will solve this problem by trapping grit and dust at their source. Write for complete information.



The Cincinnati

ELECTRIC DRILLS • GRINDERS • BUFFERS • PORTABLE TOOLS

The Cincinnati Electrical Tool Co.

A DIVISION OF THE R. K. LE BLOND MACHINE TOOL CO., CINCINNATI, OHIO

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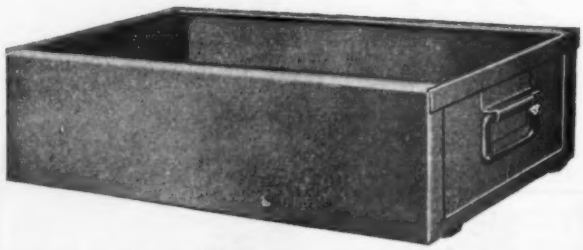
IMMEDIATE SHIPMENT!

STEEL BOXES

for your Production Needs



STACKING BOXES

An ideal all-purpose shop box. Sturdy all-welded construction; drop handles each end. Skids act as a positive stacking lock and reinforce box at point of maximum wear.

No. 301	—6"x 9"x3½"—20 Gauge—	**.55**
No. 302	—8"x12"x4" —20 Gauge—	**.60**
No. 303	—9"x13½"x4½"—19 Gauge—	**.75**

Prices F.O.B. Factory, Phila. — Any Quantity!
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AMERICAN METAL WORKS, Inc.
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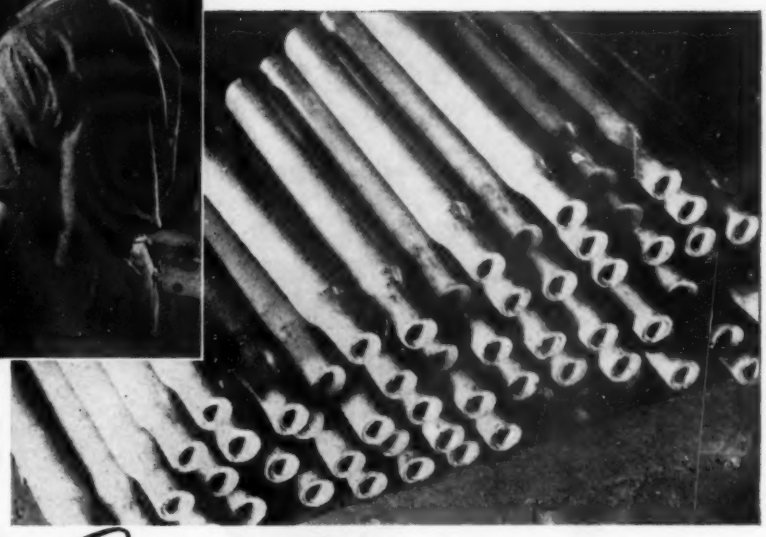


Typical of the parts being handled are those shown at the right. These parts measure up to 6" long and are Swaged from a maximum diameter of 1½" down to ⅜".

Here ETNA *Swaging Machines Stepped up Production* 600%

● Tubes, shown at the right, previously required machining on lathes or screw machines . . . until the manufacturer asked ETNA about Swaging. The result was a 600% increase in production . . . an increase of as much as 50% in part length . . . and an increase in tensile strength and size uniformity!

If your operations involve similar problems . . . tapering, sizing or reducing of round solids . . . "ask ETNA about Swaging"! Write — let us know what your particular problem is. We'll send complete information on Swaging as applied to your needs.

IF IT'S A QUESTION OF TAPERING, SIZING OR REDUCING OF ROUND SOLIDS OR TUBING

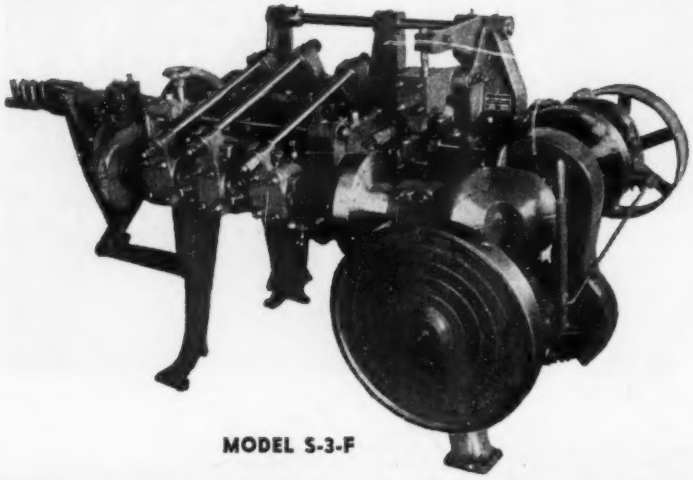
"Ask ETNA about Swaging"

THE ETNA MACHINE COMPANY

TOLEDO . . . OHIO

NILSON *Automatic Metal and Wire Forming* MACHINES

. . . assuring faster work and greater uniformity in parts produced . . . . . .



MODEL S-3-F

The new Nilson Ribbon Stock Forming Machines are a development—the result of more than fifty years specialization in the design and building of metal forming machines. They can be depended on for speed, durability and accuracy and are built in 4 sizes for handling from 3/32" to 1¼" in diameter and stock from 1¼" to 2½" wide.

Outstanding features include:

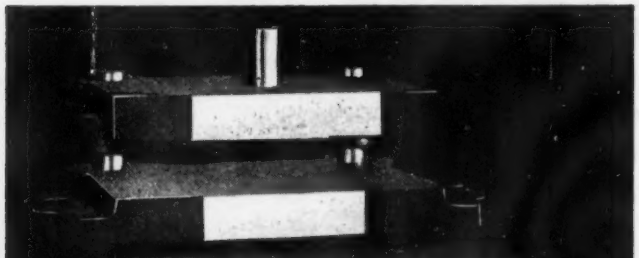
. . . open construction of the press and forming tools
. . . patented slide feed has independent cam-operated wire gripping device
. . . power operating wire feed is transmitted through a straight line.

ILLUSTRATED BULLETIN GIVING DETAILED SPECIFICATIONS . . . .

available on request

Nilson is prepared to design and produce special automatic machinery of high productive capacity. Our long experience in this class of work enables us to offer an expert and comprehensive service on special machines. Outline your problem—ask for our recommendations.

THE A. H. NILSON MACHINE CO. . . . *Bridgeport, Conn., U. S. A.*



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SEMI-STEEL and ALL-STEEL STANDARD DIE SETS
SPECIAL DIE SETS
PRECISION DIE SETS
DOWEL PINS
SPRINGS
ACCESSORIES

HEADQUARTERS FOR SPECIAL DIE SETS

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We are especially well equipped and qualified to make special die sets to your specifications and we spare no effort to give you prompt service.

Send us your prints and instructions. Your inquiries will be answered by return mail.

STEEL PLATE — fabricated and machined to your specifications.

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Die-Making Machines

They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin —also circulars on Drill pointers. Point Thinners, Mill cutter Grinders and Tap Grinders.

OLIVER OF ADRIAN PRODUCTS

Oliver Instrument Co., 1414 Maumee St., Adrian, Mich.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
THE V & O Press Co.
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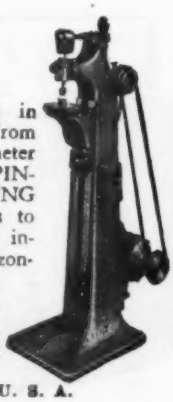
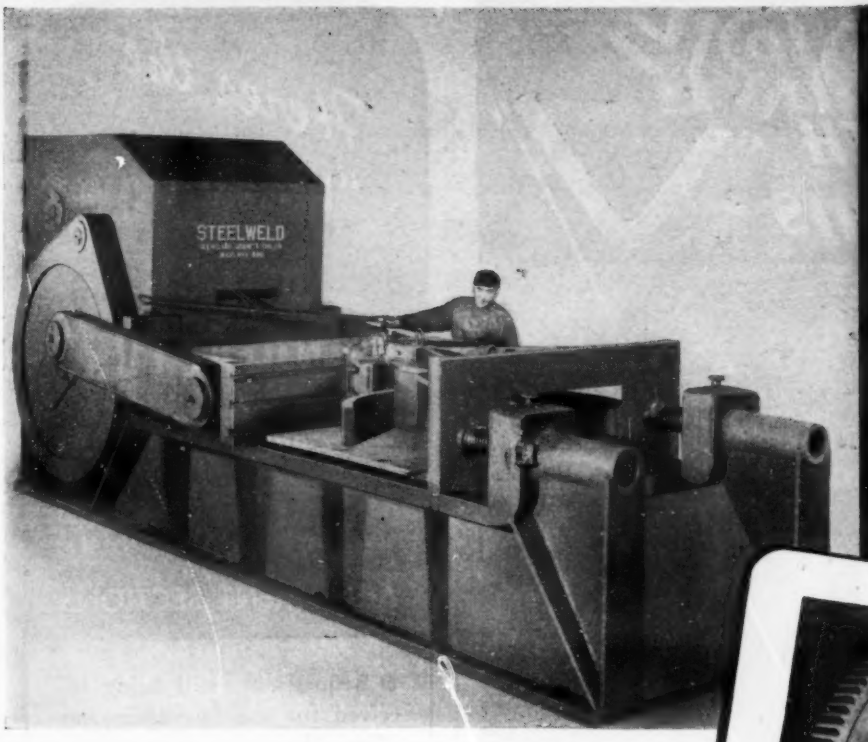
GRANT

RIVETERS — PIONEERS in their line—head rivets from smallest to ⅝" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

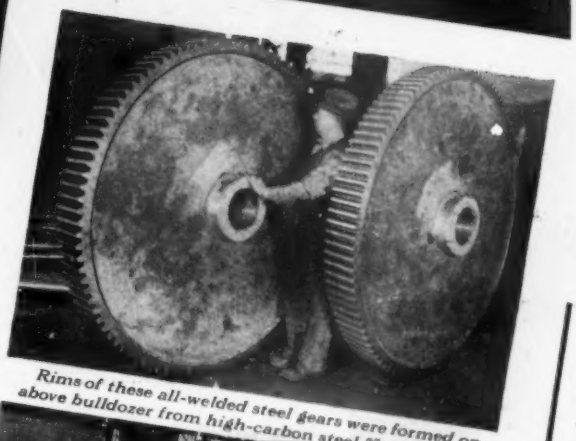


Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.



Modern Gear-Making



Rims of these all-welded steel gears were formed on above bulldozer from high-carbon steel 3" x 8".

Model 88 Cleveland Steelweld Bulldozer forming a gear rim from 2½" x 7½" high-carbon steel. Bars up 6" x 11" have been curved hot on this machine.

For husky gears of 24-inch diameter and larger, the trend today is to the fabricated construction. The rim is usually made of high-carbon or alloy steel in either one or two sections with the web plates and hub of mild steel. These parts are welded together to form a one-piece unit which is machined in the usual manner.

Gear rims are easily and accurately formed with Cleveland Steelweld Bulldozers. Because of the tremendous power of these machines very heavy rims, as well as many kinds of other work, can be handled at a high rate of production.

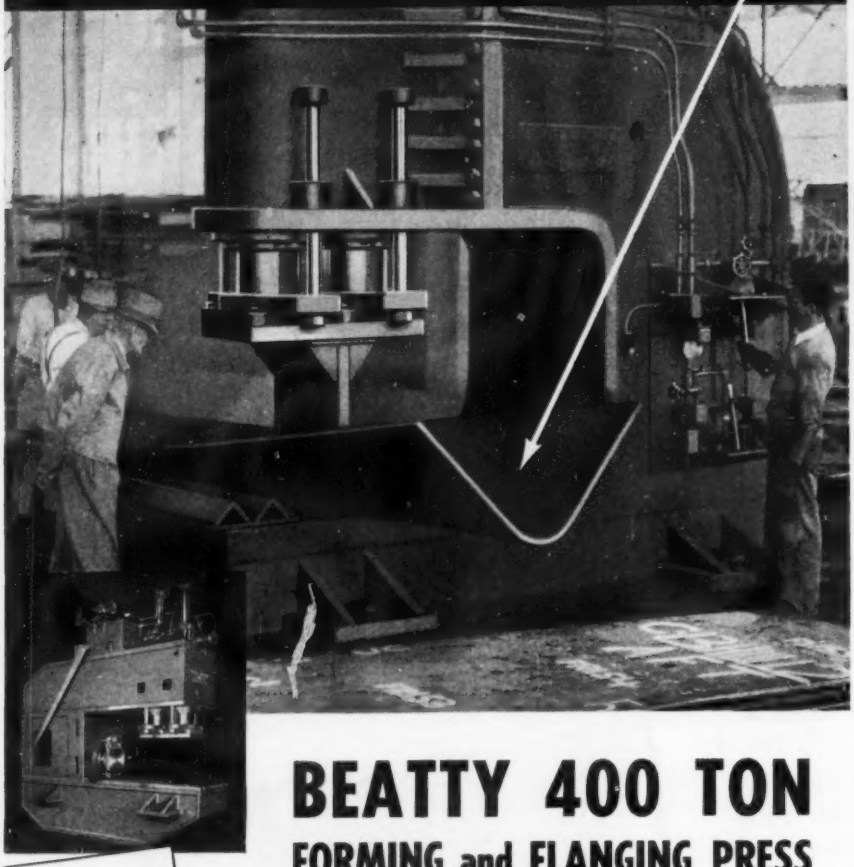
Steelweld Bulldozers have rigid one-piece all-welded frames. The machinery is of liberal design and is easily maintained. Every part is high quality made to withstand enormous loadings. For those jobs requiring brute force it will pay you to consider a Cleveland Steelweld Bulldozer.

THE CLEVELAND CRANE & ENGINEERING CO.
STEELWELD MACHINERY DIVISION
1127 EAST 283RD STREET • WICKLIFFE, OHIO.

CLEVELAND
STEELWELD BULLDOZERS

GENERAL SALES AGENTS: THE CYRIL BATH CO., E. 70TH & MACHINERY AVE., CLEVELAND

VICTORY BEGAN WITH "V" THIS —



BEATTY 400 TON
FORMING and FLANGING PRESS

Widely used by shipbuilders, and other fabricators of heavy metal, the Beatty 400-Ton Hydraulic Forming & Flanging Press has the power, speed and adaptability to break production bottlenecks. Of very latest design, this unit, with its unique type pump and valve design, eliminates the need for cooling coils, with their inherent threat of water entering the oil supply line. If you work in heavy metal, there is a Beatty machine to help smooth out your production wrinkles. Inquiries answered promptly.

Beatty designs and builds heavy duty punches, shears, coping machines, forcing presses, extruding presses, hydraulic forming presses, bulldozers and related machines.

HYDRAULIC HEAVY METAL WORKING EQUIPMENT

BEATTY MACHINE AND MFG. COMPANY
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"KNOW-HOW" of GUN MANUFACTURE

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More PRODUCTION AT *Less* EXPENSE FROM YOUR AIR TOOLS

● Carefully made of the best materials, from correct designs, CLECO pneumatic tools are built to stand the service on *any* job. However, increased production depends upon a few simple precautions, which often have no bearing directly on the tool itself. Here are a few:

Be sure to use the right grade of oil. In general, a light oil of high quality is what you need.

Avoid abusing the tool by rough handling, permitting parts to become loose; using unsuitable wrenches, or clamping the body of the tool in a vise. Leave repairing to the regular tool repair man.

Use adequate hose and pipe lines, with traps for water and trash.

Oil the tool about once an hour when the service is continuous.

Don't remove screens in connection bushings.

THIS HAMMER SURE HAS GOT A KICK TO IT !!!
120
LOOK AT YOUR AIR PRESSURE — AT 80 TO 100 LBS. THE TOOL WILL GIVE YOU MORE WORK IN THE LONG RUN, AND WILL HOLD BETTER TOO

Use air of the correct pressure, generally 80 to 100 pounds at the tool.

50,000 **OF THESE FREE BOOKLETS ARE HELPING SPEED PRODUCTION**

Have you sent for your copy?

The cartoons shown here are samples from our tremendously popular Cleco Cartoon Booklet, full of easy-to-remember operating instructions. Send *now* for your free copy.

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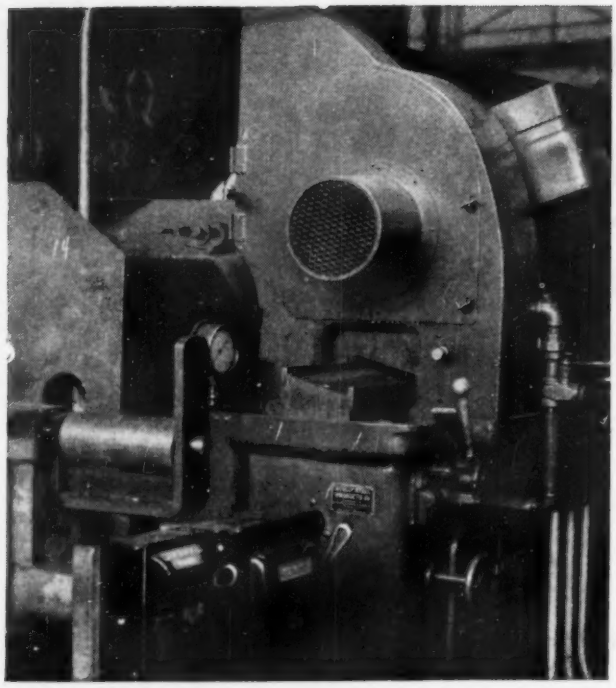
Branch Offices in All Principal Cities **3781 East 77th St., CLEVELAND 5, OHIO**



Campbell Abrasive Cutting Machines
HELP MAINTAIN SCHEDULES FOR GREAT STEEL MILL

CAMPBELL offers you the same service today that it offered the steel mill—one of whose CAMPBELL ABRASIVE CUTTING MACHINES is shown above.

All you need to do is send CAMPBELL Engineering Department data on your cutting—materials being cut, sizes, shapes, lengths before cutting, lengths of cut-off pieces and production you require per hour.

CAMPBELL engineers will then develop production procedures and costs—without any obligation on your part.

The sound foundation for this service is CAMPBELL'S experience and complete range—the only complete range—of Abrasive Cutting Machines.

These machines right now are cutting solid bar, tubular and flat stock—steels of all grades, annealed and unannealed; non-ferrous alloys; plastics; glass and ceramics. They have made it possible for many to meet wartime schedules.

Your letter will receive prompt attention.

Campbell

ABRASIVE CUTTING MACHINES

ANDREW C. CAMPBELL DIVISION
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2 STARS YOU CAN STEER BY

In selecting hack saw blades, you can safely "steer by the stars", making sure you see the STAR trade mark which appears on the genuine Clemson-made product.

THIS STAR FOR SPEEDY SAWING

When the job calls for high speed sawing, call for STAR "Moly"*, the original molybdenum alloy hack saw blade. You can tell it by its copper-color finish, a patented feature.

STAR MOLY HIGH SPEED ARE MADE

STAR UNBREAKABLE SPECIAL FLEXIBLE CLEMS

THIS STAR FOR DIFFICULT SAWING

With a STAR Unbreakable Special Flexible, you get a standard alloy blade that cuts like an all-hard, eliminating breakage in use and resisting stripping of teeth. You can tell it by its patented green finish.

TRADE MARK

CLEMSON BROS. INC.

MIDDLETOWN • NEW YORK

**T. M. Reg.—Blades bearing the name "Moly" are made only by Clemson Bros., Inc. and affiliated companies.*

Makers of STAR Hack Saw Blades, Frames, Band Saws, and Clemson D-17 Lawn Machines

4024

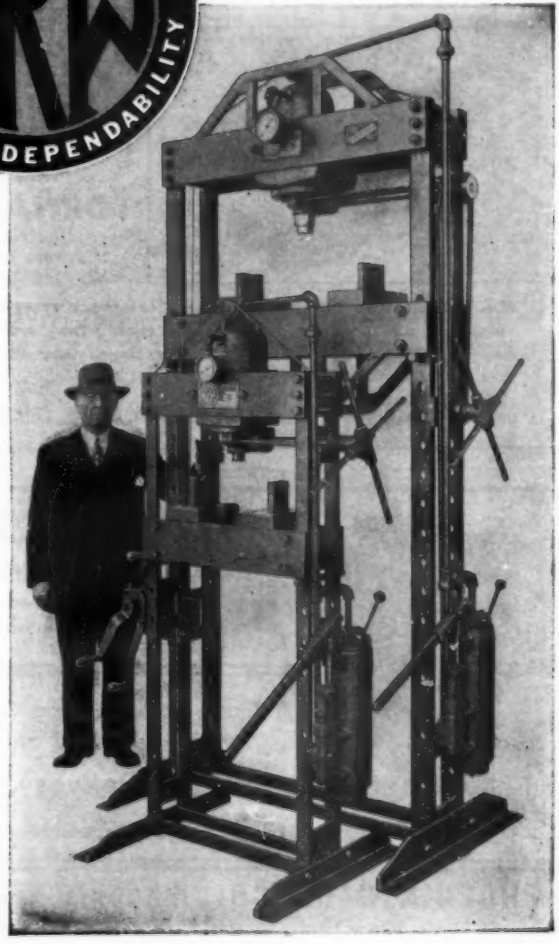
KRW HYDRAULIC ARBOR PRESSES

Engineered for War Production

★ ★

SINCE 1916 KRW A MARK OF DEPENDABILITY

Illustration below shows a special extra high 75-ton KRW Hydraulic Arbor Press in comparison with the standard 25-ton unit.



With standard KRW Hydraulic Arbor Presses as a work-proven basis, we have been able to speedily design and build many special presses for war production—without time-consuming engineering delays. The net result has been a greatly accelerated production of vital equipment which is helping to speed the day of Victory.

As an example: the large illustration shows a special, 4-man operated, air-oil press which is used extensively for bomb loading. Hundreds of these units are now in operation.

KRW also builds standard Hydraulic Arbor Presses in 25, 50 and 75-ton capacities in addition to bench-type Arbor Presses in 1/2, 1 and 3 ton capacities. If you have a problem that an arbor press might solve, talk to us. The facts concerning many successfully-solved production applications are available in our files.

K. R. WILSON
10 LOCK ST., BUFFALO, N. Y.

TAKE THE BOTTLENECKS OUT OF YOUR COLD METAL SAWING OPERATIONS

Cut your 3 inch and larger stock on the PORTER-McLEOD *and save time*

This new machine provides an economical means of handling your cutting off operations on a high production basis. More cuts, greater accuracy and lower operating and maintenance costs are outstanding advantages offered you by the 8" Porter-McLeod Cold Metal Sawing Machine.

This machine is recommended for general work and for production work in single or multiple units. Its capacity permits of "nesting" bars and shapes using the Porter-McLeod systems of "multiple or interchangeable nests" which provide support for each nest on both sides and bottom. By this method of nesting of bars and shapes, multiple units can be cut at one time and work speeded up.

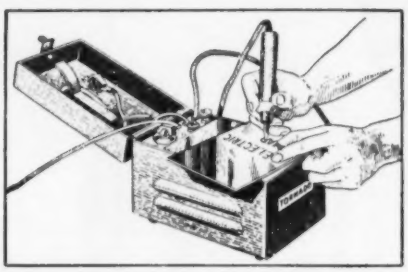
Ability to cut stock from 3 inches and up at high speed and with straight cuts is made possible by the Porter-McLeod method of pulling the blade upward through the stock and by supporting the blade, front and back on diameters well out from the center where support is needed.

These and other outstanding valuable features are fully described in engineering bulletin available on request. Send for your copy TODAY!

PORTER-McLEOD MACHINE TOOL CO., INC.

HATFIELD, MASS., U.S.A.

MACHINE TOOL COMPANY



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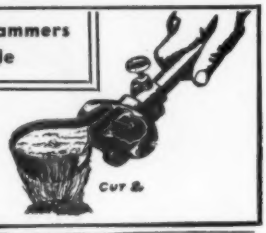
TORNADO Electric Etchers and Writing Tools mark **everything of value that** might be lost, misplaced or **stolen. They mark iron, steel,** brass, bronze, plastics, glass, etc. **Convenient, easy and** economical to use. ***WRITE FOR DETAILS***

BREUER ELECTRIC MFG. CO., 5084 N. Ravenswood Ave., Chicago, Ill.

Remelt and Cast Your Lead Hammers with the Field Mould and Ladle



Save time and money—keep lead hammers in good condition at all times—easy to use—fast. Made in 7 sizes for hammers from 1 to 11 lbs. Write for details.
Also, Lead Hammers, sizes 1 to 15 lbs. always in stock.

JOHNSON TOOL CO., INC.
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LUERS Patented Cutting Off Tool Holders Patented Cutting Off Blades

ONLY the PATENTED construction of LUERS cutting off BLADES permits normal expansion of bursting chips — MEANS MAXIMUM CUTTING EFFICIENCY.

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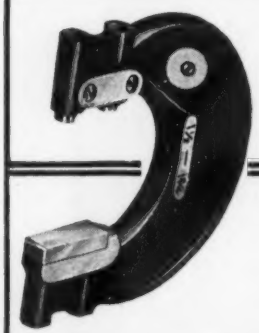

PHOENIX
ADJUSTABLE LIMIT
SNAP GAGE

A Gage with Locking Cams which will stay set

Good Delivery

Send for Folder

PHOENIX GAGE CO., Phoenix, N.Y.

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HARDNESS TESTER

BETTER and BETTER EACH YEAR SINCE 1921

WILSON
MECHANICAL INSTRUMENT CO., INC
Concord Ave. New York

LO-HED HOIST

. . . speeds up and simplifies operation of 2-ton gantry

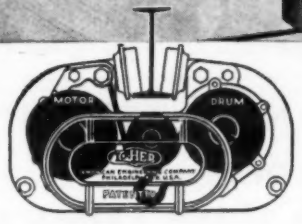
This two-legged gantry crane is entirely independent of the building for support.

A standard 2-ton Lo-Hed Hoist (plain trolley) glove-fitted into the design of the crane because a standard I-beam could be used for a rail, because "balanced construction" of the Lo-Hed permitted the hook to be drawn up to within an inch of the I-beam. That meant low headroom, a desirable plus feature, at no extra cost. Selection of a standard Lo-Hed Hoist facilitated quicker delivery.

In any hoisting job, including applications such as this, look into the possibilities of a Lo-Hed *first*. Write or telegraph for full information on Lo-Hed Hoists.

LO-HED IS THE "BALANCED" HOIST FOR HEAVY DUTY SERVICE

Other important features of the Lo-Hed Hoist are the heavy duty hoist motor; strong, short shafts; heavy duty bearings; 100% positive automatic stop; straight line spur gear drive; and removable protective covers for all vital parts.



The Lo-Hed Hoist can be adapted for operation on any monorail system. There's a Balanced Lo-Hed Electric Hoist for Every Purpose.

Other A-E-CO Products:
TAYLOR STOKERS
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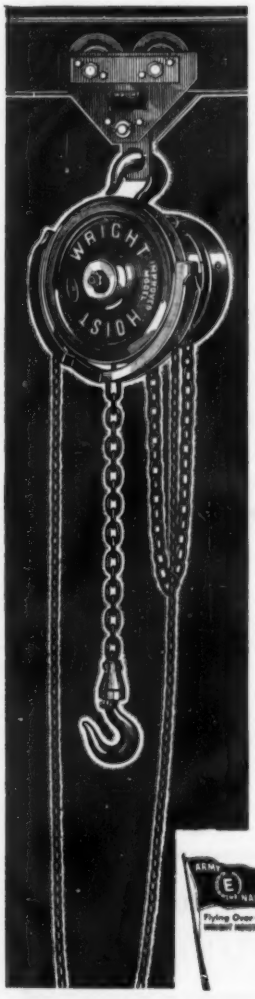

In these days of shortages we don't need to know how to choose a new hoist—but how to use an old one more efficiently, and how to make it last longer.

So—get busy with the grease gun! Where properly lubricated and maintained, many **WRIGHT HOISTS** have given constant, trouble-free service for 20 and 25 years. We have known other hoists to be so badly abused they were ruined in two years. Your **WRIGHT HOIST** will last indefinitely if you treat it right.

● If your hoist is under constant use, as on assembly line work, inspect and lubricate it at regular intervals. If it is subjected to intermittent service, then perhaps lubrication every three months and inspection every six months is sufficient. But keep your load chain well lubricated at all times. A lubricated chain will far outlast a dry chain.

Conserve steel and maintain production schedules by regular inspection and lubrication.

In Business for Your Safety

WRIGHT MANUFACTURING DIVISION

York, Pa., Chicago, Denver, Los Angeles, San Francisco, Portland, New York

AMERICAN CHAIN & CABLE COMPANY, INC.

BRIDGEPORT, CONNECTICUT

Production at New Peak on JOHANSSON GAGE BLOCKS

REQUIREMENTS of extreme manufacturing precision in war industries of the United Nations have made unprecedented demands upon our output of Johansson Gage Blocks, and we regret that our customers have had to wait so long for delivery even though every order is on priority.

Though we have increased production to the highest peak in history and speeded up deliveries, there is a long waiting list to be filled. But it is smart to place your order now. If it is on file, your chances of getting early delivery are a great deal better than they have been heretofore.

Johansson Gage Blocks and Accessories

Ford Motor Company, Johansson Div.
Dept. AM8 Dearborn, Michigan

World's Standard of Measurement

PREVENTS BREAKING TOOL BITS

Because *a file hard support under the cutter* entirely overcomes this trouble.

Send for complete catalog A37

THE READY TOOL COMPANY

Iranistan & Railroad Aves., Bridgeport, Conn.

HARDNESS TESTER

Let the SCLEROSCOPE speed up the production of that s so we can blow the Axis to HELL

Write for Circular!

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A NEW TOOL FOR CENTERING ROUND BARS

THE

WHITCOMB QUICKCENTER

IT'S FAST – IT'S EASY – IT'S ACCURATE

Increases shop output
Uses unskilled operators
Saves time and material
Increases shop profits

The Quickcenter is a new shop tool that provides a fast, easy, accurate method of centering round bars for machine work.

It is operated by placing one end of the bar on the vee-block and tightening the handwheel which, by means of right- and left-hand threads of unequal pitch, raises the block and lowers a button until the work is clamped tight. When tight, the center of the bar is in line with the center of the spindle. The lever then advances the center drill into the work.

Because operation involves only the use of a handwheel and lever, the most inexperienced operator can now center work quickly, easily and accurately.

FEATURES

The vee-block is hardened and accurately ground and is fitted with a fine phosphor bronze nut to assure long and accurate life. The button is hardened for wear resistance. The hardened and ground spindle is fitted with grease-sealed, preloaded ball bearings. The spindle is equipped with a Jacobs chuck of ½" capacity and speeds of 700, 1300, and 2300 rpm are available from a three-step vee-belt sheave driven by a ¼ hp 110-volt motor. The Quickcenter is adjusted to center within .005" and it will do in a minute what can take over half an hour on a lathe.

SPECIFICATIONS

Height—49" Length—23" Width—13"
Will center round bars from ½" to 3" diameter
Drill chuck—½" capacity
Speeds—700, 1300, 2300 rpm
Motor—110 v, ¼ hp, 1 ph
Shipping wt. approx. 400 lbs.

PRICE $250 F.O.B. FACTORY

(Price and specifications subject to change without notice.)

WHITCOMB MANUFACTURING COMPANY

TROY, N. Y.

THE CENTRAL Certified Accuracy MICROMETER
IMMEDIATE DELIVERY
All sizes from one inch to six inches available for immediate delivery from stock.
★
Central Certified Accuracy Micrometers May Be Purchased singly or in de luxe sets. Write for illustrated catalog.
Central
THE CENTRAL TOOL CO.
AUBURN . . . RHODE ISLAND
MICROMETERS OF CERTIFIED ACCURACY
MADE BY THE CENTRAL TOOL CO. AUBURN, R.I. U.S.A.
CENTRAL
FOR MORE THAN A QUARTER CENTURY SPECIALISTS IN FINE MICROMETERS
CERTIFIED ACCURACY
THE CENTRAL Certified Accuracy MICROMETER
GUARANTEE
This micrometer is triple tested and is guaranteed accurate. If for any reason you are dissatisfied with this tool, return it with this guarantee within 30 days of purchase date to dealer from whom you purchased, and full purchase price will be refunded.
This guarantee, of course, is void in case of breakage, abuse, accident or other cause not inherent in the tool itself.
The Central Tool Co.
MICROMETERS OF CERTIFIED ACCURACY
AUBURN, RHODE ISLAND

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are

WAR WEAPONS

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Invest to the limit!

Industry's New Tool . . .

MEAD BURRING MACHINE

It is a time, labor and money saver on innumerable jobs in any shop. Sharpens tools, cutters, etc., of many kinds.

Prompt shipment

MEAD SPECIALTIES CO.

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CHICAGO (6), ILL.

RANDALL & STICKNEY

New 1/10,000" Indicator

Model C-10

Range	.005"
Diameter of case	1 15/16"
Diameter over all	2 1/2"
Depth of case	7/8"
Length over all	3 1/2"
Lug or Bracket—Offset, on center if desired	Hole 3/16"
Back held in position by	4 large screws
Center of spindle to center of hole in lug	15/16"
Weight	8 ounces
Stem	9/32 diam.
Dial	0-5-0 or 0-10
Graduated	.0001"
Crystal	Non-breakable

RANDALL & STICKNEY
Waltham 54, Mass., U. S. A.
Makers of Gauges Since 1885

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Company ..... FA. 8-19-43

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Hand screw machines up to 1½ dia.
Turret lathes up to 15" dia.
Milling machines
Engine lathes
Bench lathes
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RELIANCE MACHINE & MFG. CO.
30 Irving Place, New York, N. Y.
established 1922

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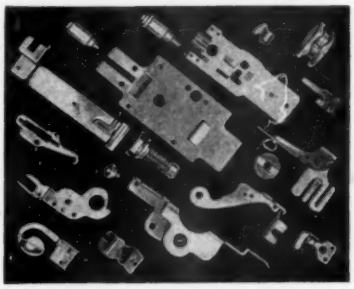
IN ALL KINDS OF METALS



Fast and efficient service on long or short runs is guaranteed by our modern equipment and methods, backed by 50 years of experience.
We also offer facilities for the manufacture of screw machine products, tools, dies, jigs and fixtures.
Quality work by skilled mechanics is assured. Send your blueprints or samples today'

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METAL STAMPINGS
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PERMANENT MAGNETS
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Your engineering problems will receive efficient and economical service in our modern plant manned with skilled workers. Contact us today for prompt quotations on your blueprints or samples.

Designers and builders of wire and ribbon stock forming machines.

THE A. H. NILSON MACHINE COMPANY, BRIDGEPORT, CONN.

MACHINE SHOP
Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmanship assure your satisfaction. Your inquiries invited.
C. VANDEGRIFT CO. HOCKESSIN, DELA.

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JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us – we will take care of them.
GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

KIRK & BLUM
CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR
OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 3/8" AND LIGHTER
THE KIRK & BLUM MFG. CO.
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Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.
KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
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AVAILABLE NOW
CYLINDRICAL GRINDING FACILITIES
Handle Stock to 4" x 13"
IMMEDIATE SERVICE
Let Us Quote You On Turning and Grinding
ACME EQUIPMENT CO.
W. C. Dept.
128 S. Clinton St. Chicago, Ill.

NEW ADVERTISEMENTS
received by August 20th, will appear in the September 2nd Issue, subject to limitations of space available.

Address copy to
Contract Work
American Machinist
330 West 42nd St., New York City

Searchlight Can Help You!

HUNDREDS of miscellaneous business problems that confront you from time to time can be quickly and easily solved through the use of the Searchlight Section of this or other McGraw-Hill publications. The Searchlight Section is the classified advertising appearing in each of these papers. Use it at small cost to announce all kinds of business wants of interest to other men in the fields served by these publications: when you want additional employees, want to buy or sell used or surplus equipment, want additional products to manufacture, seek additional capital, or have other miscellaneous business wants.

Departmental Staff, **McGRAW-HILL PUBLISHING CO., Inc.**
330 West 42nd Street, New York City

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Electronics
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Factory Management and Maintenance
Power
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Coal Age
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10 cents a word minimum charge $2.00. (See ¶ on Box Numbers.)

POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.

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BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

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The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., August 20th will appear in the issue of September 2nd subject to limitations of space available

WANTED

MACHINE DESIGNERS

Must have had several years' experience in design of automatic or semi-automatic continuous duty, light or heavy machinery. Must be thoroughly acquainted with modern methods of stress analysis and shop practice. Experience on design of textile machinery, printing presses or special machinery would be applicable. Work will be in an essential activity.

Must be a citizen of U. S. A. and produce birth certificate. If naturalized citizen, must produce naturalization papers.

Applicants who have been employed in essential activities within past 30 days will not be considered unless they have a statement of availability from their previous employer or from the War Manpower Commission.

Give complete experience, names of companies for whom worked and salary received in each position. State whether now employed and, if so, by whom employed, present salary and salary expected.

Give all information requested to assure full consideration which will be followed by personal interview at a convenient place with applicants that appear to fill our requirements.

If interview is requested in a city other than where you reside transportation expenses will be reimbursed.

E. I. DU PONT DE NEMOURS & COMPANY, INC.

Personnel Division **WILMINGTON, DELAWARE**

WANTED MECHANICAL DRAFTSMEN

For machine and tool design. Machine tool experience preferred.

Company wants men for war work today who will stay with company in postwar period.

Pleasant, midwestern town, low living costs, modern plant.

Address replies to:

1454 Guildhall Building

CLEVELAND, OHIO

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

MECHANICAL DRAFTSMAN with practical mechanical experience in blanking, drawing and forming dies for sheet aluminum products in defense plant in Midwest; give experience and full particulars. P-593, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

TOOL MAKERS for defense plant in Midwest; give experience and full particulars. P-594, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

ENGINEER, to carry-on, direct and expedite the development of new Mechanical Processes, Tooling and Electric Powered Machines and equipment. P-607, American Machinist, 330 W. 42nd St., New York 18, N. Y.

HELP WANTED—Young, or middle age, man, technical training preferred, capable of introducing speed and efficiency in medium size machine shop with large and small machine tools. Permanent position if you can produce results. P-638, American Machinist, 330 W. 42nd St., New York 18, N. Y.

DESIGNER experienced on milling machines, wanted by old established machine tool builder with highest rating. Plenty of opportunity for the right man. Communications confidential. P-639, American Machinist, 330 W. 42nd St., New York 18, N. Y.

SALES ENGINEERS wanted by machine tool dealer representing outstanding machine tool manufacturers in eastern territory. Salary, expenses, commission. Must be experienced and acquainted in eastern territory. P-640, American Machinist, 330 W. 42nd St., New York 18, N. Y.

BUSINESS SOLICITOR WANTED

A Financially Responsible progressive machine shop wants a Business solicitor. Applicant must have a successful record of Business promotion and must be able to figure jobs and have a practical working knowledge of the Business. This position will lead into an executive capacity with the company and offers an excellent opportunity to a man interested in a post war future. When writing give names of previous employers. We will not correspond with your present employer unless you request it.

General Manufacturing Co.

4204 Lyndale Ave. North, Minneapolis, Minn.

POSITIONS VACANT

WANTED: Machine Designer—Experienced on the design of special machinery and machine tools. This is an excellent opportunity for a first class man interested in a steady position in New England. Only men 35-55 with a record of successful achievements will be considered. In replying furnish complete information preliminary to a conveniently arranged interview. P-645, American Machinist, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS—This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

(Continued on the following page)

WANTED

Powder Metallurgist—Laboratory Technician

Excellent opportunity with new division of established midwestern concern. To be in charge of research and production of custom fabricated parts.

MIDLAND DIE & ENGRAVING CO.

1800 W. Berenice Chicago, Illinois

PROFESSIONAL SERVICES

Engineering and Research Co.

MACHINE DESIGNERS
MECHANICAL ENGINEERS

High Production Dies, Tools, Jigs and Fixtures, Methods, Job Analysis, Consultants and Supervisors, Industrial Engineering and Research

Chatham Phenix Building, 29-28 41st Ave., Long Island City, New York

(Continued from preceding page)

POSITIONS WANTED

SUPERINTENDENT or Works Manager. Age 41, proven ability—good engineering education—first class mechanic—familiar with productions. 16 years' executive experience. PW-642, American Machinist, 330 W. 42 St., New York 18, N. Y.

DO YOU NEED A LIVEWIRE for that "dead spot" in your organization that is aggressive with ability and willing to work, with 18 years of practical shop and executive experience. From Apprentice to Assistant to Works Manager in 18 years. Obtained all engineering studies in evenings. 32 years old with family, desires responsible position with firm anywhere that has post war program. Will get release from present employer. PW-644, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

GRADUATE MECHANICAL ENGINEER, young executive—Practical—aggressive. Successful work in Production Methods, Tool Design, Product Development and Design. Fully qualified machinist, can quickly gain confidence of "Old Timers". Wants opportunity to become member of firm in capacity of Chief Engineer, Works Manager or similar executive position. PW-641, American Machinist, 520 N. Michigan Ave., Chicago 11, Ill.

PATENT ATTORNEY

PATENTS, COPYRIGHTS, Booklet, "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Oliwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED—For advertisements of work wanted see page 304.

WANTED

WANTED—Deckel GK-2 Engraving Machine Milwaukee 1-H Plain Milling Machine Motor driven Surface Grinder, 6 x 18. Write or wire: J. E. Hawley, W. Roosevelt, Phoenix, Ariz.

ANYTHING within reason that is wanted in the fie'd served by American Machinist, can be quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper they read.

AN UNUSUAL OPPORTUNITY FOR SALESMEN OF INDUSTRIAL PRODUCTS

A large, long established concern has just started the manufacture of a completely new type of Retaining Ring (patented), which embodies a remarkable advance over all previous products of similar type.

Although introduced just recently, this product is National Aircraft Standard, and has won the approval and acceptance of some of America's largest industrial manufacturers.

Sales opportunities are almost endless, and we are seeking representation in every area of the United States.

If you are an experienced salesman of roller bearings, piston rings, gears, or any other type of equipment sold to plant engineers, and if your present position permits you to handle this splendid innovation with your current line, write immediately *outlining all facts about yourself.* Enclose photo, not returnable.

All applications will be treated in strict confidence.

RW-628, AMERICAN MACHINIST
330 W. 42nd Street, New York 18, N. Y.

SALES AGENTS WANTED

Wonderful Opportunity for Aggressive Manufacturer's Agents contacting Shop Men, Tool Engineers and Buyers to acquire exclusive agency for cutting tool line offering extensive replacement business.

Your territory coverage must be intensive, continual and technically adequate. Expert technical sales promotion assistance will be periodically given you.

Write advising of the lines you now represent, the exact territory you cover, and the extent and personnel of your organization.

RW-643 AMERICAN MACHINIST
330 West 42nd Street
New York 18, N. Y.

It is **NO** *Secret!*

The War has given birth to:

PRECISION TOOL STEELS

YOU CAN USE THEM NOW

Write for

STEEL-SIGHT MANUAL

•

WESTERN SUPPLY CO.
441 Vine St., Cincinnati 2, Ohio

SALES REPRESENTATIVE WANTED:

Manufacturer of a high quality superior designed tool (patented) for boring and reaming which has achieved national acceptance during the past two years is now, due to increased production facilities, ready to enlarge sales area and enter new territories. Several districts are available and present an attractive opportunity for local representatives who are well known in their territory and who have a thorough knowledge of the use and sale of cutting tools, to make a valuable exclusive territorial connection. A manufacturer's agent now handling non-competitive but kindred lines will find these tools a profitable addition.

If you have the necessary mechanical background and selling experience to meet the above requirements write for information giving your full qualifications.

RW-637, AMERICAN MACHINIST
520 North Michigan Ave., Chicago 11, Ill.

WANTED . . . a STAR

We are looking for a product or machine that somebody believes will fill a major need in post-war production and merchandising, and that can be manufactured in a modern toolroom. Our organization can contribute the necessary design, engineering, sales and advertising facilities to thoroughly develop and to put it on the market.

BO 636—AMERICAN MACHINIST
330 West 42nd St., New York City, 18, N. Y.

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

POST WAR PRODUCT

Wanted for purchase or manufacture, by a completely equipped manufacturing plant, which has an excellent sales organization. Write us giving details of your product or item.

BO 627, American Machinist
330 West 42nd St., New York 18, N. Y.

Don't forget the

BOX NUMBER . . .

When answering the classified advertisements in this magazine, don't forget to put the box number on your envelope. It's our only means of identifying the advertisement you are answering.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DEWITT TOOL COMPANY
173 Grand St. New York City

SALES AGENTS WANTED
on Exclusive Basis in Few Choice Territories

KNOCK-OUT KO

K. O. LEE CO.—ABERDEEN, S. D.

Manufacturers of

Universal Tool Grinders, Carbide Tool Grinders, Drill Chucks, Expanding Mandrels, Arc Welders, Valve Seat Grinders, Valve Refacers, Abrasive Wheel Dressers, Connecting Rod Aligners, Valve Seat Rings, Chuck Centers.

IN STOCK!!!

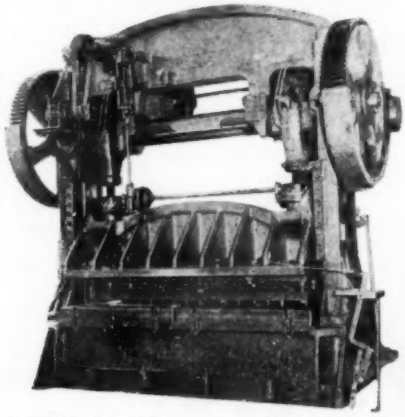
DRILLING MACHINES

Fox No. 15H mult. spdl. drill. mach., Hyd. feed, 35 No. 1 Morse taper Spindles, 17" x 34" bd., ser. No. 1005, M.D., 10 H.P., 3 ph., 60 cy., 220 v.

Fox No. D31 mult. spindle drill. mach. Drilled for 32 spindles and equip. with 16 No. 2 Morse taper Pwr. fd., 17" x 34" bd. Ser. No. 626, m.d. 10 H.P., 3 ph., 60 cy., 220 v.

Natco No. 12 mult. spindle drill. mach. Single pulley, B.D., Drilled for 16 Spindles and equip. with 6 No. 2 Morse taper. Power feed.

Toledo 94½-J 200 Ton Press



TOLEDO 94½-P 200 ton press. Straight side tie rod, double twin, direct geared M.D. with 30 H.P. 3 ph. 60 cy. 440 V. motor & Con. Forced feed lub., pneumatic controlled friction clutch & brakes. Bed area—120" right to left x 50" front to back, 12" stroke, 18" sheet height. Bed equipped with spring cushions. Weight approx. 80,000 lbs.
Sanford No. 1½ Production Miller, Rotary Table, Cleveland Vertical Miller No. 1 (New.)

GEAR SHAPERS

2—₴612 Fellows.

SHAPERS

26" Cincinnati Triple Geared Shaper. Friction Drive.
20" x 20" x 36" N-B-P Shaper-Planer, Arranged Motor Drive.

STRAIGHTENING MACHINE

No. 5-18½ Littell Single Rack & Pinion Feeding and Straightening Machine.

Presses, Brakes and Shears

MARIETTA Power Press Brake 104" between uprights. Dual rams to permit operations on separate dies from both sides of press. Bed area 20" x 104", each ram 6¼" x 98". 4" crank shaft, 3" stroke. Excellent condition.
Ohl power square Shear 8' 10 gauge.
Kutscheld all steel 36" x 16 ga. Foot Shear.
No. 132 Bliss 14 ga. 18" throat Slitter.
No. 232 Bliss 12 ga. 18" throat slitter.
No. 306 Bliss Straight Side, Tie Rod, 8" stroke, air cushion, motor drive, Press.
No. 65 N Bliss Straight Side, Tie Rod, Geared, 125 ton, 6" stroke, air cushion, motor drive, Press.
No. 3½C Bliss Toggle Press, Tie Rod, Vee belt motors.
No. 3½C Bliss Toggle Press, Solid Frame, Vee belt Motor Drive.
No. 3 A Bliss Toggle Press, 5½" shaft, Vee belt Motor Drive.
₴20 Bliss O.B.I. 2½" stroke.

LATHES

Putnam 30" x 12' Heavy Duty Screw Cutting Engine Lathe, QCG.
Putnam 26" x 12' Heavy Duty Screw Cutting Engine Lathe, QCG.

PRODUCTION LATHE

2—Lelliond No. 9 Automatic Lathes, capacity 9" swing, 16" between centers, geared head, arranged motor drive with motors for 3 phase, 60 cycle, 440 volt service. Equipment includes back facing attachment, oil pump and piping. New in 1929 and guaranteed in first class mechanical and operating condition. Special price for immediate sale.

TURRET LATHES

ACME 1½" cap., power feed to turret, screw cross slide, bar feed, 6 hole hexagon turret, collets, turret tooling, arranged M.D. 60-3-220/440 volt.
Foster 1" capacity Geared Friction Head, Hand Operated Turret and cross slide, collet, belt drive.
21" Gisholt Universal Turret Lathe with 3⅝" hole in spindle, 2-step one for 5" belt.
Jones & Lamson 3 x 36 Double Spindle, air chuck equipment.
Jones & Lamson 3 x 36 Single Spindle, Geared Head, Single Pulley Drive.

BORING MILLS

24" Bullard Vertical Turret Lathe Rapid Production, motor drive.
30" Colburn Vertical Turret Mill, M.D.
3½" Rochester Floor Type Horiz. Boring Mill, M.D.

GRINDERS

No. 6 Besley Double Opposed Disc Grinder.
No. 2 and No. 3 Brown & Sharpe Cutter Grinder.
Gorton, double end Disc Grinder, 18" discs.
Greenfield No. 12, Hydraulic Feed, motor drive; cap. swings 15". Grinds automatically ⅝" to 5" dl., 4" deep. New in 1928.

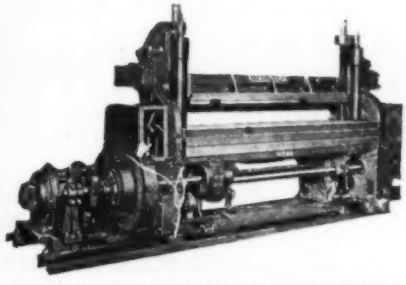
COILING MACHINES

No. 1 and No. 2 Sleeper & Hartley BX cable coil. mach., ⅜ and ½ in. cap. Last used for speedometer cable. Complete.

DRILLS

BAKER—₴5 M.T.

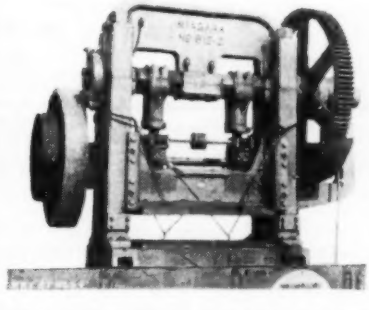
₴98 NIAGARA



HEAVY PRODUCTION FOLDER

6' x 14 gauge capacity. Ar. M.D.
Working length 72", cap. 14 gauge; min. width of fold at cap. 1" gaging range (narrow folds) ⅝" to 1⅝", max. gaging range 72" left of chamfering bar 3". Shipping wt. 12,690 lbs. Like new.

200 TON NIAGARA



1—Niagara ₴612 D press. Straight side, double crank, back geared, 200 ton cap., 3" stroke, bed 60 x 38.

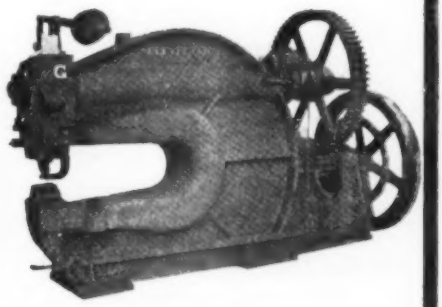
PLANERS

POND 72" x 72" x 18' table; 2 heads on rail, 2 side heads.
CINCINNATI 30" x 30" x 10' table, M.D.
PUTNAM 48" x 48" x 12' table, M.D.

PROFILERS

P. & W. No. 12 2-spindle motorized Profiler, Table 12" x 15" equip. with 6" rais, blocks, and 5 H.P., 3 ph. 60 cycle, 220 V. motor—Turner drive mounted and wired to push button control—rebuilt and guaranteed.

MODEL G CLEVELAND GAP PUNCH



Vertical Cleveland, model G open Gap Punch, 52" throat, arch Jaw, 2" hole thru 1" plate cap. arrange for Gear motor drive. 10 H.P., 3 ph., 60 cy., 220 v.

Buy From Stock
MACHINERY
Tel. Main 6347
FALK
MACHINERY CO.,
18 WARD ST.
MERCHANTS
ROCHESTER 5, N.Y.

GEAR MACHINES

36" G. & E. Cutter
B. & S. No. 3-26" Cutter
Gleason 11" Bevel
Fellows No. 6, 61 Sharper

BORING MILL

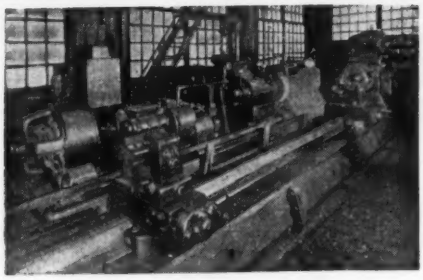
10', 60" Niles Vert., 2 heads
54", 62" Colburn, M. D., 2 heads
2½" G. & Lewis, M. D.
2½" Binsee
3½" Rochester, M. D.
4", 4½" Gisholt and Niles
36" Bausch, Niles, 2 heads
42" Bullard, 2 heads
36" Bullard VTL Turret

LATHES

48" x 26' Niles
48" x 14' B. & Emmes Q.C.
26" x 14' Rahn-Larmon, rais. blks. to 34", Q.C.
36" x 21' Wickes 3 step, Q.C.
30" x 20' LeBlond Std. chg.
24" x 12' LeBlond, M. D.
26" x 24' Putnam, S.Q.C.

AUTOMATICS

3—Potter & Johnston No. 6A Turret Lathes, M. D.
10—Gridley ¾"—4¼" sgl. and multiple spindles



50" x 28'

NORTON

ROLL GRINDER, M. D.

MILLING MACHINES

Cincinnati No. 4 Vert., SPD
Cincinnati No. 5 Plain, M. D.
B. & S. No. 33, M. D.
Milwaukee No. 3 Vert., S.P.D.
Cleveland No. 2 Univ., S.P.D.
Cincinnati No. 2, 3 Univ., M. D.

GRINDERS

P. & W. 14", M. D., B. B.
Norton 12 x 18", M. D.
Landis 14 x 52", S.P.D.
Modern 12 x 28" M. D.
B. & S. No. 10, 11, 14
Blanchard 26" Surface S.P.D.
Diamond 12 x 36", M. D.

TURRET LATHES

Gisholt 24", 6¼" hole
Gisholt 28", 3¼" hole
Gisholt 21", 3½" hole
Libby 18", S.P.D.
Bullard, King 36" VTL. Turret
King 34" VTL. Turret
W. & S. No. 3A, S.P.D.
Foster No. 1B, S.P.D.

HYDRAULICS

Elmes 600 ton Hobbing press, 18" ram, 10" stroke
1—Elmes 1⅛" x 4" Horiz. 4 plunger pump, 6⅛ GPM, 5000#, WP.
1—W-F 1000 ton press, 20" ram, 7" stroke
1—W-F High-Low Pump, 60 GPM at 300#, WP., 3 GPM at 6500 High WP
1—500 ton press, 15" ram, 16" stroke, 28" x 34" platen
1—Triplex Pump 1 x 5, 1000 cu. in. 6000# WP.

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9" Pratt & Whitney Gear Grinder, M.D.
11" Gleason Bevel gear generator
No. 61 Fellows
Cimatool gear chamfering, M.D.
Lees-Bradner Gear Grinder
Lees-Bradner Model S.H. 6" x54" spline-Gear Hobber, M.D.

TURRET LATHES

6 x 6½" Goss & DeLeeuw
3" x 36" Jones & Lamson, M. D.

MISCELLANEOUS

No. 16 Blanchard M.D.
#2A Becker Vertical Miller
2 #2 Avey 2 spdl, Aveymatic Feed
8" Bullard Multimatic M.D.
36' x 36" x 8' Woodward & Powell Planer Rev. M.D.

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1—36"x36"x10' Gray Heavy Duty Double Housing Planers
1—24"x24"x 6' Gray Double Housing Planer
1—24"x12' Putnam Engine Lathe
1—20"x10' Flather Engine Lathe
1—20"x 6' Flather Engine Lathe
1—18"x 6' Monarch Engine Lathe

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Drill, ceiling suspended, unlimited drilling area
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Drill, six-spindle Henry & Wright, 12" overhang
Drill, two spindle sensitive, #1 Morse taper
Grinder #20 Bryant deep hole internal
Grinder 60" plate
Grinder #60 Heald, cylinder
Grinder, Sellers Tool
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Lathe, 24" x 18' Steptoe-McFarlan
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Punch & Shear, two ¼" capacity
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Turret Lathe L & D brass, cross slide turret
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PRESS, Hydraulic 1000 ton **WOOD** Platen 42" x 9', stroke 18", daylight 36", motor drive.
PRESS, Toggle No. 14 **BLISS**, bed area 48" x 52", tie-rod, stroke 26", motor drive.
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- 2½" Cleveland Model A, single spindle

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- American Hydraulic
- Oilgear Hydraulic

DRILLS
- Barnes Camelback, single spindle
- Avy Sensitive, 3 spindle
- Barnes Camelback, 4 spindle
- Leland-Gifford, Sensitive, P.F., 3 spindle

GEAR CUTTERS
- No. 6 Fellows Gear Shaper
- No. 5A Lees-Bradner Gear Generator
- No. 3 Brown & Sharpe Automatic
- 96" Gleason Gear Planer
- 15" Gleason Spiral Bevel Generator
- No. 10 Lees-Bradner Gear Grinder
- 30" Rochester Gear Tooth Rounder

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- 22" x 48" Pratt & Whitney Vertical Spindle Surface, Timken Bearing
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- 12" Walker Rotary Surface
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- 10" x 72" Brown & Sharpe Cylindrical
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- No. 70 Heald Internal

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- 7" x 52" Fitchburg Lo Swing, g.h.
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- No. 2 Acme Full Universal, g.h.
- No. 2A Warner & Swasey, g.h.
- No. 2B Foster, g.h.
- 24" Steinle, g.h.
- No. 6A Potter & Johnston, g.h.
- 1½" x 9" Acme Ram Type, c.d.

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- 42" Niles Bement Pond Vertical Boring, m.d.
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- No. 2 Cincinnati Plain, s.p.d.
- No. 3 Ryerson-Conradson Plain, s.p.d.
- No. 12 Brown & Sharpe, c.d.
- No. 3 Brown & Sharpe Vertical, s.p.d.
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- 1 spindle Leland & Gifford, p.f., No. 2 Taper
- 1 spindle Taylor & Fenn, No. 2 Taper
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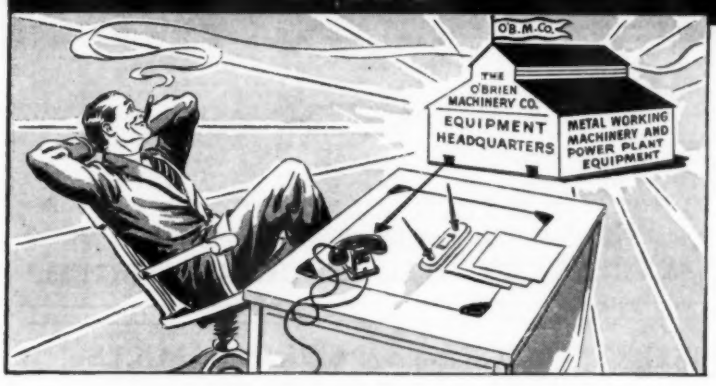

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Compressor, 1400 cu. ft. Sullivan WN3
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Drill, 24" Colburn D3, heavy duty
Drill, 20" Barnes A.G.S.O.
Drill, No. 16 Natco multi, 24 spdl.
Drill, No. 1 Baush, multi, 16 spdl.
Drill, Type 3H Natco horizontal
Drill, W. F. & J. Barnes vertical boring, reaming & drilling, hyd. feed
Drill, Rehnberg-Jacobson, 16 spdl. production
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Gear shaper, Z2 (No. 624) Fellows
Gear hobber, No. 16 HS Gould & Ederhardt
Grinder, No. 2 Cincinnati Centerless
Grinder, No. 3 Cincinnati universal
Grinder, No. 34 Gardner, 24" opposed spindle
Grinder, No. 15A Bryant internal
Hammer, 50 lb. Bradley upright
Keyseater, No. 4 Mitts & Merrill
Lathe, 36" x 16' Putnam heavy geared Bed.
Lathe, 24" x 16' Schumacher & Boye
Lathes, 22" x 26" Libby turret, M.D.
Lathe, 8" Sundstrand Stub
Lathe, 14" x 19" Fay automatic
Lathe, 3" x 3" Jones & Lamson
Miller, No. 2 1/2 Rockford
Miller, No. 4 Cincinnati
Miller, Taft Peirce thread
Miller, Type C Hall Planetary thread
Miller, No. 3 Turn Millers
Miller, Nos. 10 & 45 Productomatic
Planer, 29" x 29" x 6' 3" New Haven
Planer, 24" x 24" x 6' Woodward & Powell
Press, No. PA3 Ferracute horning
Press, No. 8-7 Zeh & Hahnemann str. side
Press, No. 33 Toledo arch
Presses, Nos. 180 & 796 1/2 D Toledo, toggle drawing
Presses, Nos. 201 & 203 General Flexible
Punch, 5/8" x 3/4" x 26" throat Rock River
Riveters, Nos. 2A hy., 5 1/2 B & 7B High Speed
Rolls, No. 1A Ajax taper forging
Rolls, No. B60 Yoder fender crown
Roll, Waterbury Farrel thread roller
Saw, 36" Newton cold
Saws, Nos. 12, 14 & 17 Higley cold 4" to 8" capy.
Shaper, 24" Gould & Eberhardt
Shaper, 36" Morton draw-cut
Shears, 8" x 8" x 1" Long & Allstatter angle
Shears, 2" capy. Newbold guillotine
Slotter, 4" Garvin
Swagler, No. 6 HS Langelier
Topper, No. 2X Garvin
Topper, 1" & 1 1/2" National
Threader, 2" Landis bolt 2 spdl.
Upsetter, 4" Ajax
Welder, 150 KVA Swift, butt

MISCELLANEOUS

Casing coiler, 3/4" No. 319 Sleeper & Hartley
Spring coiler, No. 5, 3/8" capy. Sleeper & Hartley
Hone, No. 211 Barnes
Lathe, Molling 6 cyl. crankshaft
Sand Mixer, Baker Perkins
Screw Driver, No. 61AA Bodine
Washer, Blakeslee metal
Wire machine, 3/8" x 3' Shuster
Threader, 1" Cleveland automatic double end
Gear checker, National Tool, for gears & cutters
Grinder, Cincinnati face milling cutter
Buffer, Hawes No. 575 for polishing
Die Casting Machine, A. C. Spark
Screw driver, Model C Detroit
Tester, 60,000 lb. Tinius Olsen drop
Washer, Blakeslee, conveyor type

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AUTOMATICS, Gridley, 3/4" Model F, M.D.
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AUTOMATICS, Potter & Johnston #5A & 6A
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BORING MILLS, 42" Gisholt, 1 Turret & S.H.
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GEAR SHAPERS, #7 High Speed, M.D.
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GRINDERS, Heald B. S. 12" Mag. Chuck
GRINDERS, Landis, #1 Universal
GRINDERS, Norton, 14x36" Plain, M.D.
LATHE, Steinle Turret, 24" with 4" & 6 1/4" Hole through Spindle
MILLING MACHINE, #8 Becker Duplex, M.D.
MILLING MACHINES, Becker Vertical, Model C 30" Rotary table, & Model S. D. 40" R. T.
MILLER & DRILLER, Knight #2
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PLANERS, 42x42"x12' Ohio, 1 Head, M.D.
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6" Bilgram Bevel Gear Generator.
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Lees Bradner Gear Grinder.
#3—26" B & S Gear Cutter.
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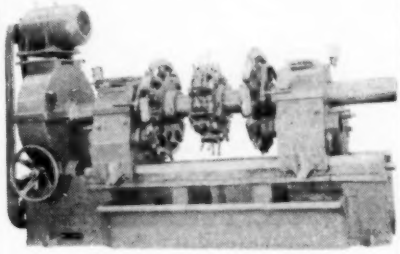

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ADVERTISERS INDEX

	Page
Abbott Ball Co.	194
Abrasive Machine Tool Co.	255
Acme Machine Tool Co.	37
Acme Pattern & Tool Co., Inc.	166
Acromark Corp.	164
Adams Company	194
Allegheny-Ludlum Steel Corp.	165
Allis-Chalmers Mfg. Co.	34, 35
Almond Mfg. Co., T. R.	268
American Brake Shoe Co.	244
American Chain & Cable Co., Inc.	296, 300
American Chemical Paint Co.	180, 181
American Cutter & Engineering Corp.	284
American Engineering Co.	299
American Magnesium Corp.	47
American Metal Works, Inc.	195, 290
American Optical Co.	64h
American Pulley Co.	203
American Screw Co.	163
American Tool Works Co.	16
Ampco Twist Drill	128
Apex Machine & Tool Co.	218
Armstrong-Blum Mfg. Co.	64e
Armstrong Bros. Tool Co.	64g
Arter Grinding Machine Co.	256
Automatic Machine & Tool Co.	246
Automotive Maintenance Machinery Co.	251
Avey Drilling Machine Co., Inc.	263
Axelson Mfg. Co.	226
Bakelite Corp.	176, 177
Baker Bros., Inc.	267
Bakewell Mfg. Co.	265
Baldwin-Southwark Div. Baldwin Locomotive Works	135
Bantum Bearings Div. The Torrington Co.	198
Barber-Colman Co.	30
Barnes Drill Co.	264
Barrett Co., Leon J.	174
Baumbach Mfg. Co., E. A.	288
Bausch Machine Tool Co.	222
Beatty Machine & Mfg. Co.	294
Bilgram Gear & Machine Works	192
Bissett Steel Co.	172
Blake Co., Edward	262
Blanchard Machine Co.	64
Blank & Buxton Machinery Co.	272
Blount Co., J. C.	250
Bodine Corp.	269
Boice-Crane Co.	202
Boker & Co., Inc., H.	164
Braun Gear Co.	192
Breuer Electric Mfg. Co.	298
Brewster-Squires & Co.	210
Bridgeport Machines, Inc.	286
Bridgeport Safety Emery Wheel Co.	212
Bristol Co.	163
Brown & Sharpe Mfg. Co.	207
Bryant Chucking Grinder Co.	36
Buckeye Brass & Mfg. Co.	200
Buhr Machine Tool Co.	262
Bullard Company	51
Burke Machine Tool Co.	286
Butterfield Co., Div. of Union Twist Drill Co.	42
Cadillac Gage Co.	22
Campbell, Andrew C., Div. American Chain & Cable Co., Inc.	296
Carbide Fabricators Co.	275
Carboloy Co., Inc.	145
Carborundum Co.	249
Card Mfg. Co., S. W.	43
Carlton Machine Tool Co.	264
Carpenter Steel Co.	62, 63, 178
Central Screw Co.	163
Central Tool Co.	302
Century Electric Co.	211
Chandler Tool Co.	195
Challenge Machinery Co.	202
Chandler Products Corp.	163
Chaso Tool Co.	282
Chicago Wheel & Mfg. Co.	148
Cincinnati Bickford Tool Co.	79
Cincinnati Electrical Tool Co.	260
Cincinnati Gear Company	193
Cincinnati Grinders, Incorporated	10, 11
Cincinnati Lathe & Tool Co.	212
Cincinnati Milling Machine Co.	4, 5
Cincinnati Planer Co.	48
Cities Service Oil Co.	167
Clark Controller Co.	217
Clemson Bros., Inc.	296
Cleveland Crane & Engineering Co.	293
Cleveland Hobbing Machine Co.	33
Cleveland Planer Co.	274
Cleveland Pneumatic Tool Co.	295
Cleveland Punch & Shear Works Co.	28
Cleveland Tool Engineering Co.	240
Cone Automatic Machine Co., Inc.	23
Continental Screw Co.	163
Corbin Screw Corp.	163
Coulter Machine Co., James	278
Covel Mfg. Co.	247
Crafts Co. Inc., Arthur A.	302
Criterion Machine Works	250
Cross Gear & Machine Co.	77
Cullen-Friestedt Co.	182
Cushman Chuck Co.	245
Dalzen Tool & Mfg. Co.	233
Danly Machine Specialties, Inc.	288
Davis Keyseater Co.	282
Dearborn Gage Co.	153
DeSanno & Son, Inc., A. P.	259
Desmond-Stephan Mfg. Co.	254
Detroit Die Set Corp.	292
DeVlieg Machine Co.	46
Do All Co.	231
Domestic Industries Siewek Tool Div.	187, 188
Earle Gear & Machine Co.	193
Eastern Machine Screw Corp.	288
Erie Foundry Co.	243
Errington Mechanical Laboratory	266
Etna Machine Co.	291
Ex-Cell-O Corp.	64b, 64c
Fafnir Bearing Co.	215
Fellows Gear Shaper Co.	8, 9
Fidelity Machine Co.	250
Fitchburg Grinding Machine Corp.	44
Foote-Burt Co.	45
Ford Motor Co. (Johansson Gage Div.)	300
Forsberg Manufacturing Co.	186
Fosdick Machine Tool Co.	57
Gallmeyer & Livingston Co.	246
Ganschow Gear Co.	192
Gardner Machine Co.	257
Gear Specialties, Inc.	192
General Electric Co.	50, 52, 74, 238, 239
General Machinery Corp. (Mass.)	212
General Machinery Corp. (Ohio)	26
Genesee Tool Co.	137
Geometric Tool Co.	288
Gisholt Machine Co.	64a
Gleason Works	3
Goss & deLeeuw Machine Co.	234
Grant Gear Works	192
Grant Mfg. & Machine Co.	292
Gray Co., G. A.	266
Greenfield Tap & Die Corp.	29
Gulf Oil Corp.	171
Hall Planetary Co.	278
Hamilton Tool Co.	270
Hanna Engineering Works	288
Hardinge Brothers, Inc.	73
Harnischfeger Corp.	27
Harper Co., H. M.	163
Hartford Special Machinery Co.	192, 280
Haskins Co., R. G.	268
Haynes Stellite Co., Div. Union Carbide & Carbon Corp.	228
Heald Machine Co.	2nd Cover
Hecker, A. W.	235
Hill Acme Co.	258
Hobart Brothers Co.	164
Hoefer Mfg. Co.	264
Holman Reamer Co.	266
Hones, Inc., Charles A.	164
Horton & Son Co., E.	58
Hovis Screwlock Co.	209
International Nickel Co.	175
International Screw Co.	163
James Co., D. O.	195
Jefferson Machine Tool Co.	212
Johnson Machine Co., Carlyle	194
Johnson Tool Co., Inc.	298
Jones & Lamson Machine Co.	6, 7
Kearney & Trecker Corp.	20, 21
Kempsmith Machine Co.	17
Kennametal, Inc.	147
Kent-Owens Machine Co.	277
Kingsbury Machine Tool Corp.	72
Knight Machinery Co., W. B.	279
Kux Machine Co.	220
L. W. Chuck Co.	276
Lamson & Sessions Co.	163
Landis Machine Co.	14, 15
Landis Tool Co.	18, 19
Lavalle and Ide, Inc.	266
Leach Machinery Co., H.	212, 236
LeBlond Machine Tool Co., R. K.	75
Lee Co., K. O.	240
Lees-Bradner Co.	65
Leland Gifford Co.	264
Lincoln Electric Co.	199
Linley Bros. Co.	284
Lodge & Shipley Machine Tool Co.	133
Lovejoy Tool Co., Inc.	281
Lucas Machine Tool Co.	266
Luers, J. Milton	298
McCaskey Register Co.	170
McGraw-Hill Book Co., Inc.	244, 286
Machinery Mfg. Co.	197
Macklin Co.	242
Magnus Chemical Co.	172
Matthews & Co., James H.	284
Mattison Machine Works	253
Mead Specialties Co.	302
Meehanite Research Institute	32
Meisel Press Mfg. Co.	194

ADVERTISERS INDEX

(Continued from preceding page)

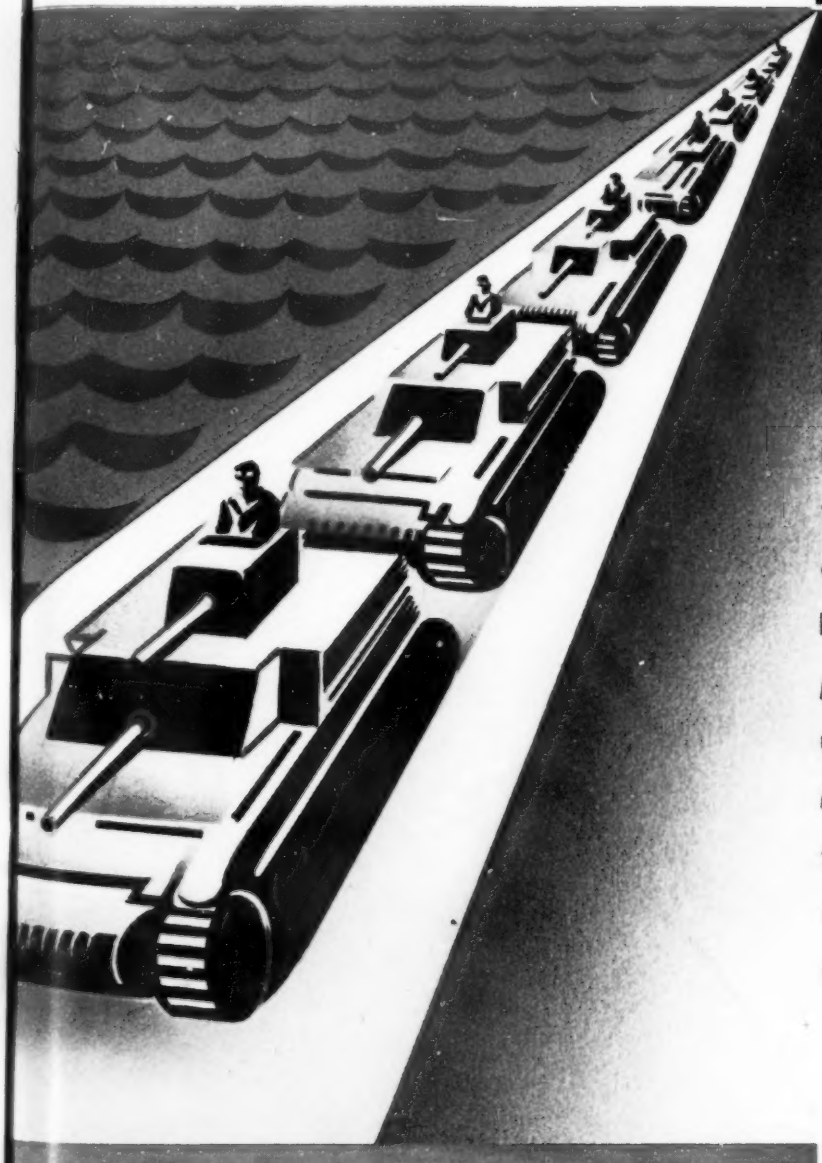
	Page
Merz Engineering Co.	210
Metal Textile Corp.	178
Metro Tool & Gage Co.	53
Micromatic Hone Corp.	66, 67
Mid-West Abrasive Co.	40
Mitts & Merrill	286
Modern Tool Works	271
Monarch Machine Tool Co.	24, 25
Moore Special Tool Co.	156
Morey Machinery Co., Inc.	224, 282, 284
Morris Machine Tool Co.	82
Morse Chain Co.	204
Morse Twist Drill & Machine Co.	273
Motor Tool Manufacturing Co.	236
Murchey Machine & Tool Co.	227
National Acme Co.	205
National Lock Washer Co.	219
National Machine Tool Co.	270
National Refining Co.	159
National Screw & Mfg. Co.	163
Newark Gear Cutting Machine Co.	194
New Britain-Gridley Div., New Britain Machine Co.	3rd Cover
New England Screw Co.	163
Niagara Machine & Tool Works	289
Nichols-Morris Co.	280
Nicholson & Co., W. H.	220
Nilson Machine Co., A. H.	292
Noble & Westbrook Mfg. Co.	184
Norgren Co., C. A.	186
North Bros. Mfg. Co.	146
Norton Co.	38, 39
Oakite Products, Inc.	160
Ohio Oil Co.	157
Oliver Instrument Co.	292
Onsrud Machine Works, Inc.	283
Osborn Manufacturing Co.	248
Parker Co., Charles	163
Parker-Kalon Corp.	163
Pawtucket Screw Co.	163
Pheoll Mfg. Co.	163
Philadelphia Gear Works	191
Phillips Screw Mfgrs.	163
Phoenix Gage Co.	298
Porter-McLeod Machine Tool Co., Inc.	298
Potter & Johnston Machine Co.	54, 55
Pratt & Whitney Div. Niles-Bement-Pond Co.	76
Production Machine Co.	270
Producto Machine Co.	270
Progressive Welder Co.	189
Quaker Chemical Products Corp.	139
Quaker City Gear Works, Inc.	193
Queen City Machine Tool Co.	260
Racine Tool & Machine Co.	216
Randall & Stickney	302
Ransome Machinery Co.	174
Reading Screw Co.	163
Ready Tool Co.	300
Reed-Prentice Corp.	282
Reeves Brothers, Inc.	184
Reliance Electric & Engineering Co.	201
Republic Steel Corp.	168, 169
Revere Copper & Brass, Inc.	141
Rhode Island Tool Co.	252
Rivett Lathe & Grinder, Inc.	64d
Robbins Engineering Co.	256
Roberts Rubber Co., Weldon	56
Rockford Machine Tool Co.	287
Royersford Foundry & Machine Co.	288
Russell, Burdsall & Ward Bolt & Nut Co.	163
Ruthman Machinery Co.	220
Ryerson & Son, Inc., Jos. T.	144
Salem Engineering Co.	179
Savage Tool Co.	225
Schatz Mfg. Co.	166
Schauer Machine Co.	236
Scherr Co., Inc., George	68
Scovill Manufacturing Co.	163
Sellers & Co., Inc., Wm.	64f
Seneca Falls Machine Co.	223
Shakeproof, Inc.	163
Sheldon Machine Co.	236
Shore Instrument & Mfg. Co., Inc.	300
Sigourney Tool Co.	268
Simmons Machine Tool Corp.	230
Simonds Worden White Co.	252
Sinclair Refining Co.	154
Smit & Sons, Inc., J. K.	164
Smith & Mills Co.	286
Smith Tool & Engineering Co.	182
Sommerfeld Machine Co.	190
South Bend Lathe Works	71
Southington Hardware Mfg. Co.	163
Sparks Machine Tool Co.	61
Specialties Mfg. Co., Inc.	214
Specialty Products Co., Inc.	185
Springfield Machine Tool Co.	220
Square D Co.	155
Standard Conveyor Co.	151
Standard Electrical Tool Co.	254
Standard Gage Co., Inc.	31
Standard Oil Co. (Indiana)	161, 162
Standard Pressed Steel Co.	220
Star Electric Motor Co.	213
Steelweld Machy. Div., Cleveland Crane & Engrg. Co.	293
Stevens, Inc., John B.	282
Stuart Oil Co., D. A.	182
Sundstrand Machine Tool Co.	241
Sun Oil Co.	78
Surface Combustion Corp.	173
Swan Finch Oil Co.	183
Threadwell Tap & Die Co.	221
Timken Roller Bearing Co.	4th Cover
Tomkins-Johnson Co.	229
Torrington Co.	143, 288
Trundle Engineering Co.	152
Turchan Follower Machine Co.	285
Turco Products, Inc.	184
Turner Uni-Drive Co. (Sales Div. Turner Machry. Co.)	208
Union Carbide & Carbon Corp.	176, 177, 228
Union Drawn Steel Div.	168, 169
Union Twist Drill Co.	41
Universal Boring Machine Co.	264
Universal Engineering Co.	268
V & O Press Co., Inc.	292
Van Keuren Co.	59
Van Norman Machne Tool Co.	12, 13, 69
Vard, Inc.	237
Vascaloy-Ramet Corp.	158
Vickers, Inc.	149
Vulcan Corp.	178
Walker Co., Inc., O. S.	234
Waltham Machine Works	246
Warner & Swasey Co.	80
Waterbury Steel Ball Co.	210
Weatherhead Co.	206
Webber Gage Co.	126
Wesche Electric Co., B. A.	196
Westinghouse Electric & Mfg. Co.	49, 70
Wheel Trueing Tool Co.	254
Whitcomb Mfg. Co.	301
Whitney Screw Corp.	163
Wickman Corp.	232
Williams Co., J. H.	261
Wilson, K. R.	297
Wilson Mechanical Inst. Co., Inc.	298
Worthington Pump & Machinery Corp.	60
Wright Mfg. Div. American Chain & Cable Co., Inc.	300
Wyckoff Drawn Steel Co.	150
Zeh & Hahnemann Co.	286
PROFESSIONAL SERVICES	305

SEARCHLIGHT SECTION

Classified Advertising

Classification	*Page*
BUSINESS OPPORTUNITIES	306
CONTRACT WORK SECTION	304
Acme Equipment Co.	304
General Pattern Works	304
Greist Mfg. Co.	304
King Foundries, Inc.	304
Kirk & Blum Mfg. Co.	304
Nilson Machine Co., A. H.	304
Reed Machine & Tool Eng.	304
Reliance Machine & Mfg. Co.	304
Thomas & Skinner Steel Products Co.	304
Vandergrift Co., C.	304
PATENT ATTORNEY	306
POSITIONS VACANT	305
POSITIONS WANTED	306
REBUILDING SERVICE	309, 310, 312
Hill-Clarke Machy. Co.	309
Indianapolis Machinery & Supply Co., Inc.	310
Simmons Machine Tool Corp.	312
SELLING OPPORTUNITIES	306
WANTED TO PURCHASE	314
USED SURPLUS EQUIPMENT	306-314
Aaron Machinery Co.	308
Advance Machinery Exch. Inc.	314
Atlantic Machinery Corp.	308
Bennett-Rafkin Machine Tool Co., Inc.	314
Canal Machinery Co.	312
Cincinnati Machinery & Supply Co.	313
Columbia Axle Co.	314
Covington Electrical Mechanical Co.	314
DeWitt Tool Co.	306
Dony Machinery Co., D. E.	312
Eastern Machinery Co.	310, 314
Emerman & Co., Louis E.	313
Falk Machinery Co.	307
Galbreath Machinery Co.	312
Hill-Clarke Machinery Co.	309
Hyman & Son, Joseph	308
Indianapolis Machinery & Supply Co.	310
Industrial Machine Tool Co.	314
Lang Machinery Co.	308
Marsh Machy. Co., A. R.	313
Miles Machinery Co.	312
Morey Machinery Co., Inc.	310
National Machinery Exchange	308
O'Brien Mach. Co.	311
Osborne & Sexton Machinery Co.	308
Ott Machinery Sales, Inc.	312
Patron Transmission Co.	314
Paul's Motor & Mchy. Supply	313
Precision Machine Works	312
Reed-Prentice Corp.	313
Simmons Machine Tool Corp.	312
S & S Machinery Co.	313
Strong Carlisle & Hammond Co.	312
Western Supply Co.	306
West Penn Machinery Co.	312
Wigglesworth Machinery Co.	308
Zeeve & Co., Alex.	308

ON AND OFF THE GROUND



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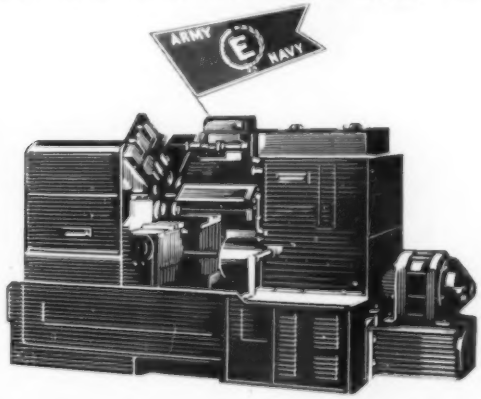

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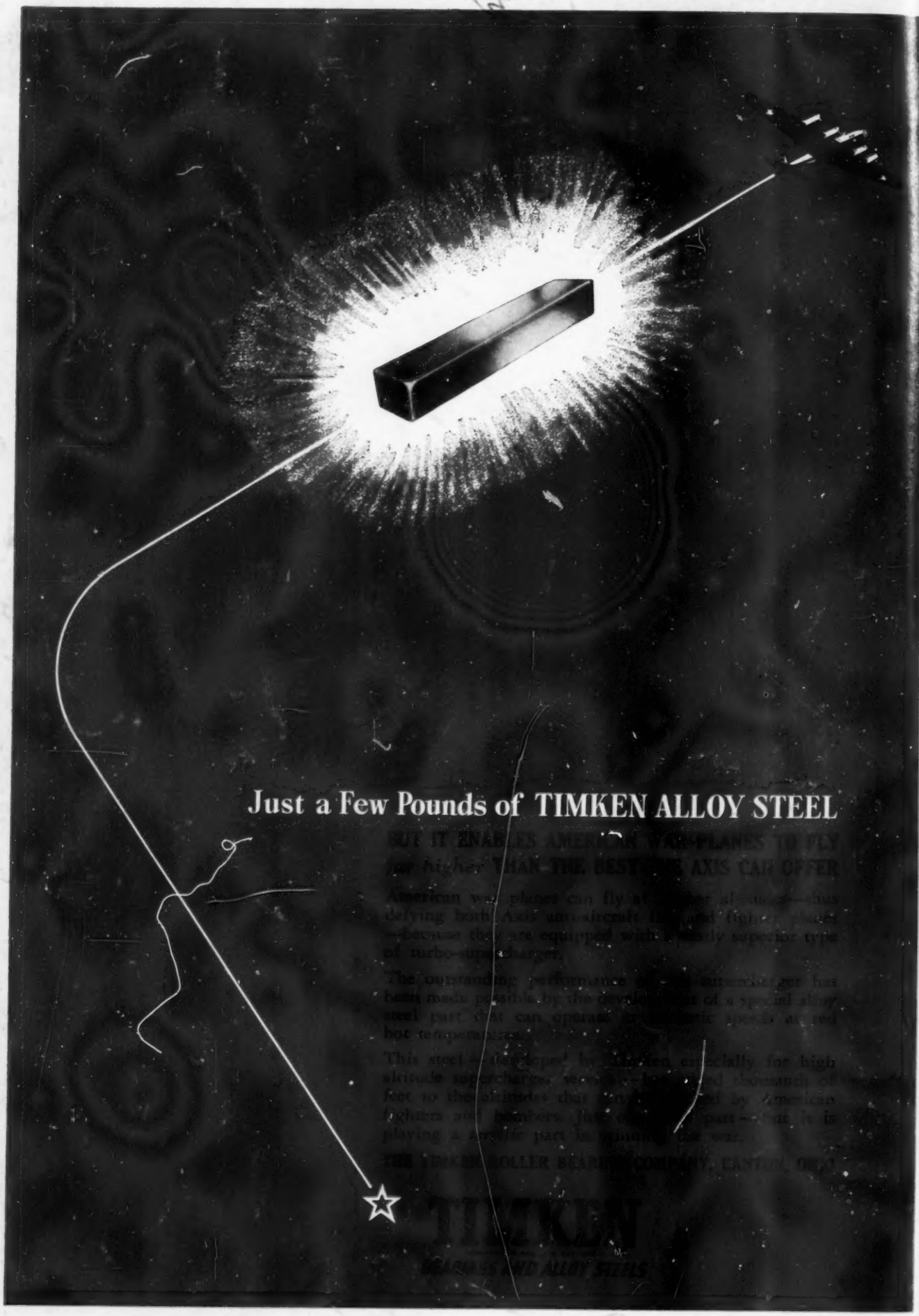
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